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AUTOMATION

An Outstanding Method of Increasing Production

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AUTOMATION is a new word coined by the Ford Motor Co. to designate automatic feeding, unloading, and handling of work to, from, and between production machines. An Automation department has recently been established by the company which is devoted to designing and applying mechanical or electrically controlled mechanisms that will speed the flow of work along the production line.

By means of such devices, equipment can be operated at its highest productive capacity, labor can be utilized to maximum efficiency, and safety is considerably increased. First applied in press shops, Automation devices have now been successfully employed for the first time on a production line that includes various machine tools.

One of the closest approaches ever made to a completely automatic mass-production plant is the Highland Park plant of the Ford Motor Co., built for the manufacture of valve guide bushings. From the time the casting is ground to length until it has been centerless-ground, drilled, reamed, formed, grooved, faced, bored, inspected,

AUTOMATION AT

Fig. 1. Cast Valve Guide Bushings are Ground to Length on a Double-spindle Disk Grinder. Special Hoppers are being Considered to Permit Automatic Loading of This Machine

and phosphate-coated, it is not touched by human hands.

The total Ford requirements for both intake and exhaust valve guide bushings—over 100,000 per day—are produced in this "Automated" plant. Four identical production lines are provided to grind the valve guide bushings for V-8 engines. Each line consists of a double-spindle disk grinding machine (Fig. 1), for grinding the bushings to length, and four centerless grinding machines (Fig. 3), for progressively finishing the outside diameters of the castings. About 14,000 bushings are processed in eight hours on each line, giving a total monthly production of almost 3,000,000 parts. Only two operators are required for each grinding line, one to load the disk grinder and another to maintain the four centerless grinders.

Solid valve guide-bushing castings are received from the Rouge foundry in rectangular steel containers, and are automatically loaded into large hoppers of inverted pyramid shape, in front of each grinding line. The castings, which are about 2 1/4 inches long, with two diameters, of 5/8 and 1 inch, have been heated at 1580 degrees F. for twenty minutes and slowly cooled, to attain a Brinell hardness of 141 to 168. The cast-iron parts slide from the hopper to a tray adjacent to a Hanchett double-spindle disk grinder, Fig. 1, where they are ground to length.

At present, the bushings are placed manually in notches around the periphery of a rotary type work-carrier, being located axially from a groove cast in the bushings. A hold-down mechanism with adjustable tensioning device holds the castings in the notches while they pass between two opposed abrasive disks, 30 inches in diameter. Agitated type hoppers are being considered to provide for automatic loading of the grinder.

From 0.045 to 0.050 inch of stock is ground from each casting, maintaining the length of the part within $\pm$ 0.005 inch. A production of more than forty bushings per minute is obtained.

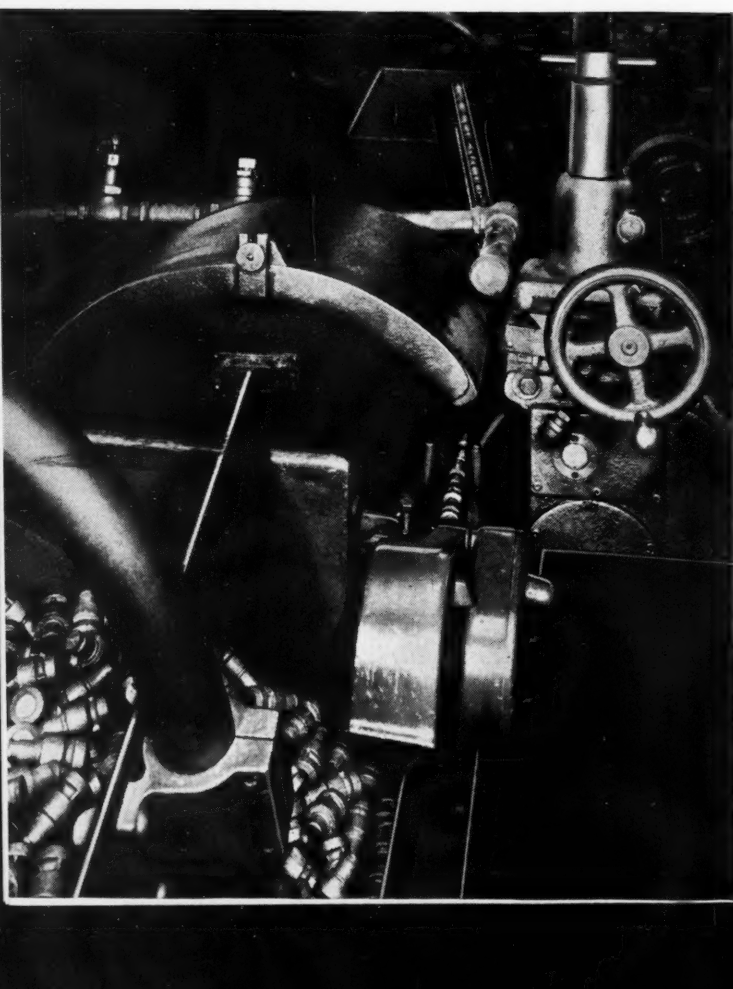


Fig. 2. From a Hopper of an Automatic Feeding Attachment the Parts Pass through a Centerless Grinding Machine at a Production Rate of Forty Valve Guide Bushings per Minute

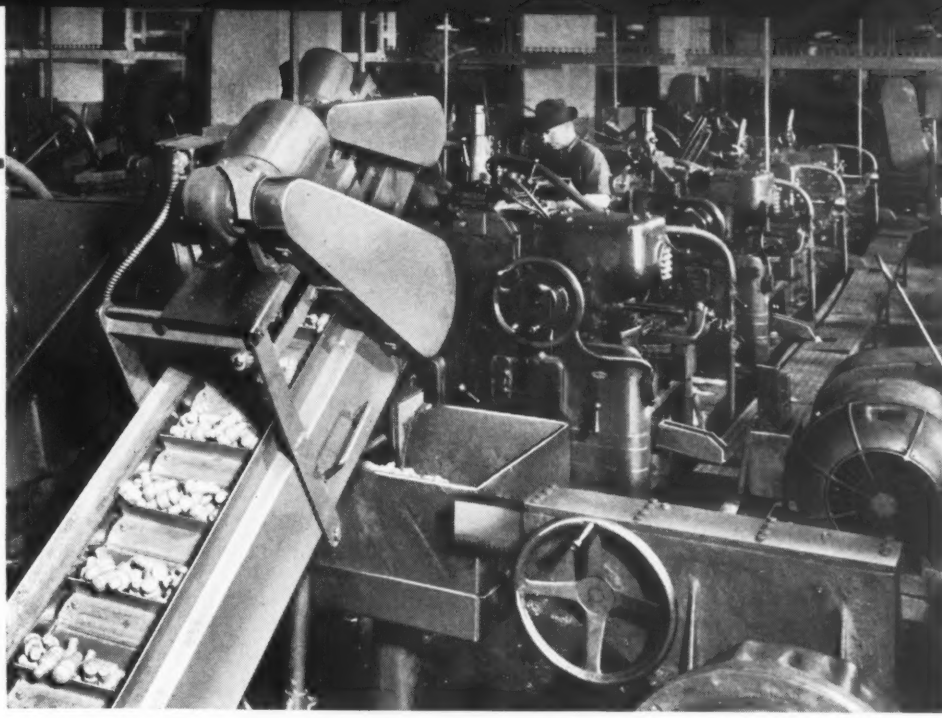


Fig. 3. A Total of 0.048 Inch is Removed from Periphery of the Valve Guide Bushings as They are Automatically Fed through Four Centerless Grinders

Resinoid-bonded aluminum-oxide abrasive disks having a coarse grain (20), a medium grade (P), and a 4 structure are employed.

After passing between the abrasive disks of the double-spindle grinder, the bushings fall out of the rotary carrier onto an inclined conveyor which carries them to the hopper of a Cincinnati automatic feeding attachment. From this hopper, the parts are automatically fed, end to end in a continuous line, through the first Cincinnati centerless grinder, Fig. 2.

About 0.020 inch of stock is removed from the larger diameter of the bushing in the first centerless grinding operation. Grinding wheel, regulating wheel, and work-rest of the machine remain in a fixed position relative to each other, the work being fed between these members along the line of its own axis.

After the work has passed between the wheels of the first machine, it is conveyed to another hopper for automatic feeding to a second centerless grinder. About 0.013 inch of stock is removed from the two diameters of the bushing in this pass. Both first and second grinding machines are equipped with vitrified-bonded silicon-carbide abrasive wheels, 24 inches in diameter by 6 inches wide, of medium grain (30) and P grade. The grinding wheels are rotated at 1160 R.P.M., while the regulating (feed) wheels, which are 14 inches in diameter, revolve at 94 R.P.M.

For the third and fourth passes, vitrified-bonded aluminum-oxide abrasive wheels, 20 inches in diameter by 6 inches wide, of 46 grain and M grade, are employed. About 0.010 inch of stock is removed in the third pass, and 0.005 to 0.006 inch in the fourth pass. The abrasive wheels rotate at 1750 R.P.M. and the 12-inch diameter regulating wheels at 94 R.P.M. on these two machines. Diameters are held within

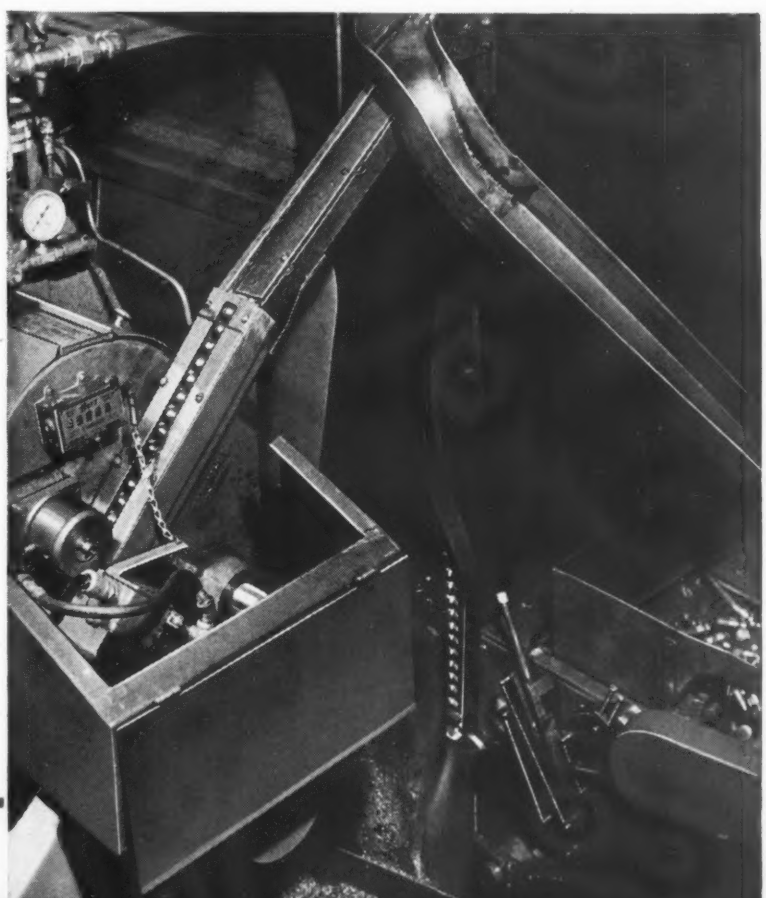


Fig. 4. Bushings in the Hopper at Lower Right are Forced up Twisted Chute in the Center, and Slide down Chute at Left for Loading in Six-spindle Automatic

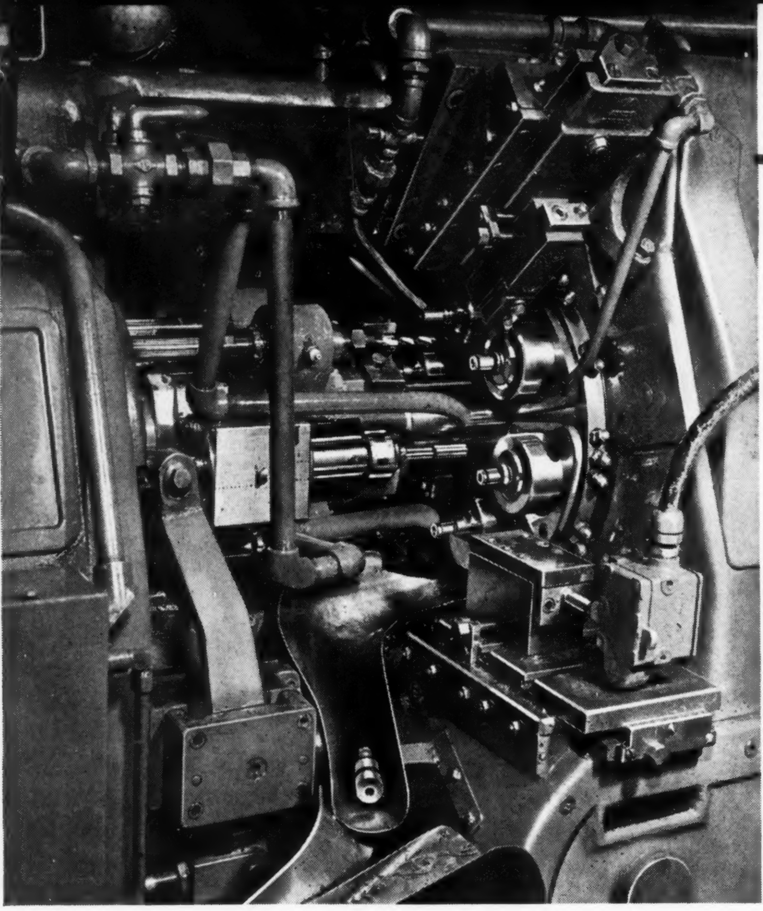


Fig. 5. Rear View of a Six-spindle Automatic Employed to Drill, Ream, Form, Groove, and Face Valve Guide Bushings at a Rate of 870 per Hour

± 0.0005 inch of the desired size on the fourth pass. Each machine grinds over forty bushings per minute. Bushings are periodically spot-checked for size, run-out, taper, and three-point bearing by means of Sheffield visual gages located along the grinding line.

Wheels on the centerless grinding machines are dressed once a day, or after grinding about 14,000 bushings. From 0.005 to 0.007 inch of abrasive is removed per dressing by means of a hydraulically operated diamond dressing attachment. Abrasive wheels can be used until they wear down to 14 inches in diameter, representing a grinding life of about 600,000 bushings.

Individual coolant pumps are not required on the various machines because the coolant drains from the machines through trenches on the floor to a centrally located sump. The coolant is pumped from the sump to a Hoffman coolant clarifier. Clean coolant is recirculated to the individual machines by centrally located pumps.

After passing through the centerless grinding machines, the bushings fall onto a mesh conveyor and are carried through a continuous washing machine, where they are sprayed with a hot alkaline solution to remove abrasive, grease, and foreign matter. Heat retained from this wash acts as a drying agent, so that when the bushings emerge from the washer they are practically free from moisture.

The parts are then conveyed to automatic feed hoppers adjacent to eleven Acme-Gridley six-spindle automatics. A view of the conveyorized set-up for carrying parts from the washer to the multiple-spindle automatics can be seen in the heading illustration. The automatic feed hoppers are kept filled to capacity by means of by-passing deflectors, or gates, which divert

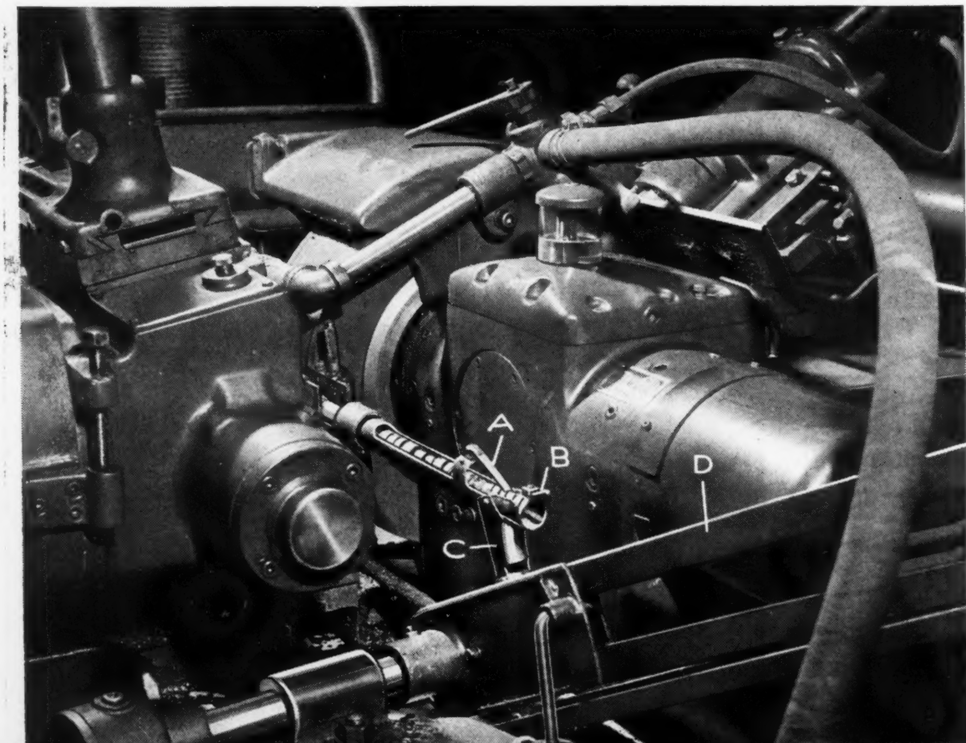


Fig. 6. After being Centerless-ground, the Bushings are Correctly Positioned on Conveyor D by Means of the Hinged Levers A and B

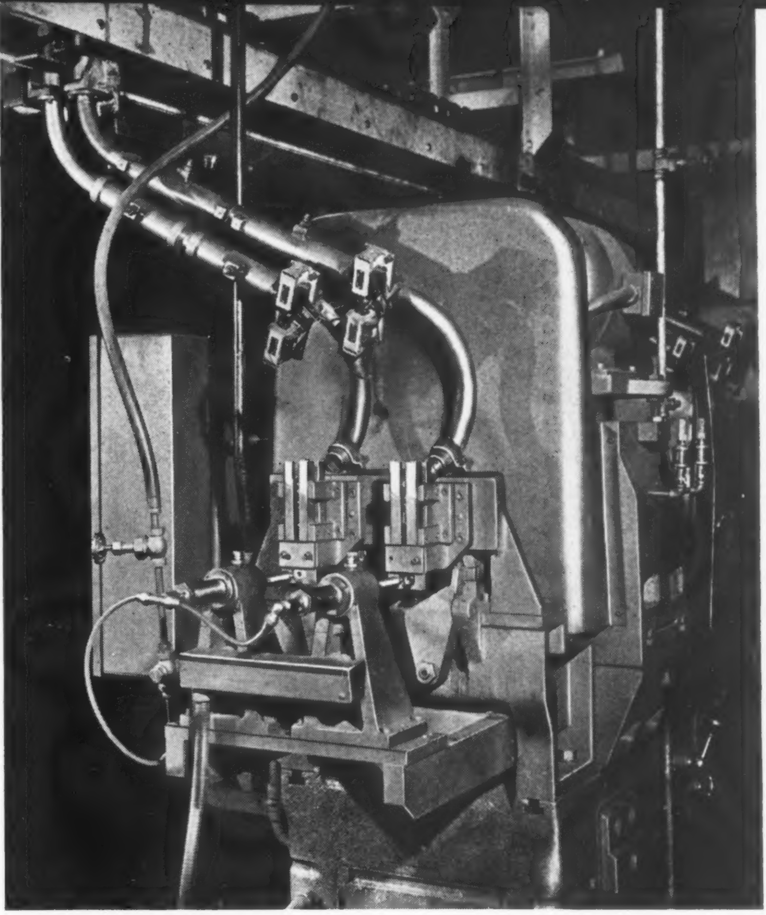


Fig. 7. Bushings Traveling on an Overhead Conveyor Drop down Chutes into Magazines for Automatic Loading of Double-spindle Boring Machines

some of the bushings to a chute leading to the hopper. When the hopper is filled, the gate automatically closes and the bushings continue along the conveyor to another hopper. The weight of the hoppers controls the action of the gates, either permitting the bushings to enter or causing them to pass by.

The hoppers are supported at each corner by springs. When they are empty, the springs have little compression and extend about 3 inches higher than when full. Inasmuch as the bushings leave the hopper through a flexible tube, no complications arise from this variation. As the hopper becomes filled, the springs compress, and when the hopper reaches a low point, which denotes that it is filled to capacity, a switch is contacted, thus closing the gate, or bypass deflector, on the conveyor overhead. If all hoppers should be filled at one time, a danger light would signal this condition.

From the hopper, seen at the right in Fig. 4, the castings are automatically and continuously pushed up the twisted chute in the center and roll down the angular chute shown at the left into a magazine. Thence they are fed, one at a time, through the rear of the hollow spindles into the collets of the six-spindle automatic machine by a cam-actuated loading plunger. A stop positions the bushing and a trip-lever causes the chuck jaws to clamp the part firmly. When the angular loading chute is filled, surplus parts roll down the open-top chute seen at the upper right, and back into the hopper.

Bushings are drilled, reamed, formed, grooved, and faced at the rate of 870 per hour on each six-spindle automatic. This represents a production of more than 3,000,000 pieces per month for the eleven machines, based on two eight-hour shifts per day. The only manual operations required on these machines are periodic checks of machine set-up and product quality.

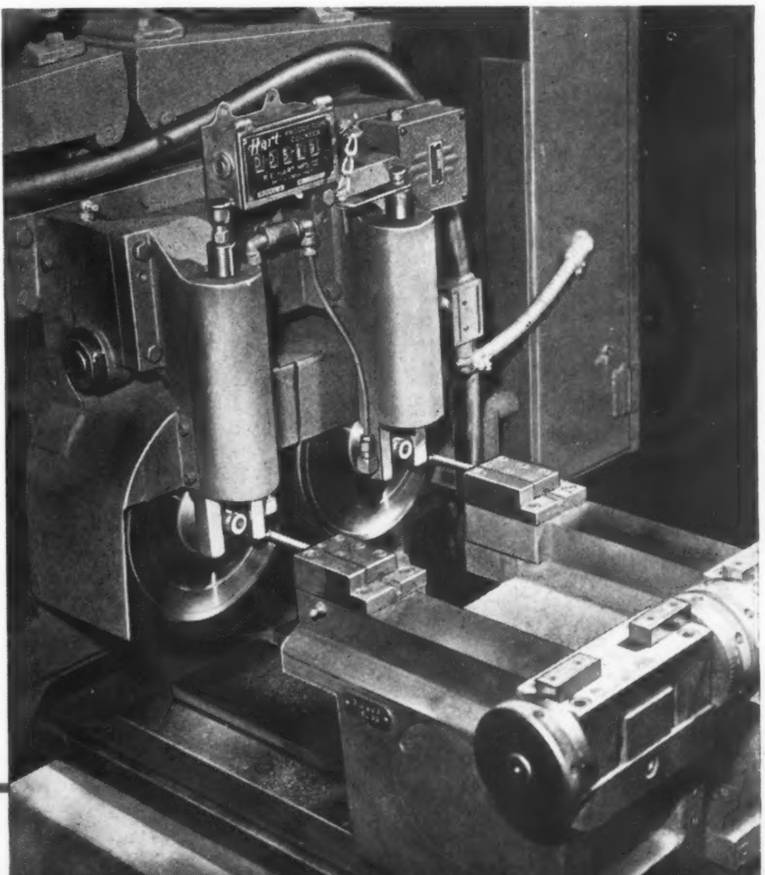


Fig. 8. Double-spindle Automatic Machine for Rough- and Finish-boring Valve Guide Bushings at the Rate of 380 per Hour

The bore of the solid valve guide bushing, 0.323 inch in diameter by 2.22 inches long, is progressively drilled in about 5/8-inch steps at five stations, each step overlapping the previous one. At the sixth station, a cam-actuated accelerated reaming attachment, Fig. 5, is employed to finish the bore. The special drills are rotated at a surface speed of 130 feet per minute, fed at the rate of 0.0075 inch per revolution, and are changed after each eight-hour run.

Spindle speeds of 792 R.P.M. rotate the parts at 213 surface feet per minute. Carbide-tipped form tools are used to form, groove, and face the castings. These tools are fed at the rate of 0.006 inch per revolution for 1/4 inch, and at 0.002 inch per revolution for 1/32 inch. Although a coolant is not required for these operations, a light oil is employed to flush away the chips and keep the collets clean, so as to insure concentric chucking. The tolerance on the concentricity of the bore with the outside diameter of the part is 0.002 inch.

After being ejected from the automatics, the bushings slide down a chute to a rubberized conveyor which carries them to the finish-grinding operation. Outside diameters of the bushings are finish-ground on two Cincinnati centerless grinding machines. These machines remove 0.0015 to 0.002 inch of stock from each diameter at the rate of sixty bushings per minute. Vitrified-bonded aluminum-oxide abrasive wheels, 20 inches in diameter by 6 inches wide, of 60 grain, M grade, and 5 structure, are employed. The grinding wheel is rotated at 1750 R.P.M., and the regulating wheel at 94 R.P.M. Although the diameters of the bushings are ground within the close limits of ± 0.00025 inch, there are practically no rejected parts in this operation.

For the subsequent boring operation, it is necessary that the bushings be positioned vertically in trays on the conveyor, with their large-diameter, heavy ends downward, as they leave the finish-grinding machine. This is accomplished automatically by the use of a unique directional selector, consisting of two hinged levers *A* and *B*, seen at the rear of the centerless grinding machine in Fig. 6. When a bushing leaves the grinder with its large-diameter end first, it is pushed down tube *C* onto conveyor *D* by lever *A*. When a part comes from the grinder with its small-diameter end first, lever *B* enters the bore of the part, and then lever *A* pushes the heavier, opposite, end of the part down tube *C* first.

After being conveyed through another washing machine, the valve guide bushings are dropped into chutes at the rear of Ex-Cell-O double-spindle automatic boring machines. Here, again, Automation comes into play. The bushings slide from the chutes into vertical magazines directly above the hollow spindles of the precision boring machines, as seen in Fig. 7. Parts are fed, one at a time from each magazine, into the hollow spindles of the machine by air-operated plungers. Each hollow spindle holds thirteen parts, and as the fourteenth part is forced into the rear of the spindle, a completed part is ejected from the chuck at the front of the machine.

Bushings are located axially in the double-diaphragm chucks by vertical plungers that automatically drop in front of the bushings to limit their forward travel through the hollow spindles. When the parts

Fig. 9. Some of the Valve Guide Bushings are Bored on Manually Loaded, Five-station, Ten-spindle Vertical Boring Machines at the Rate of 1400 per Hour

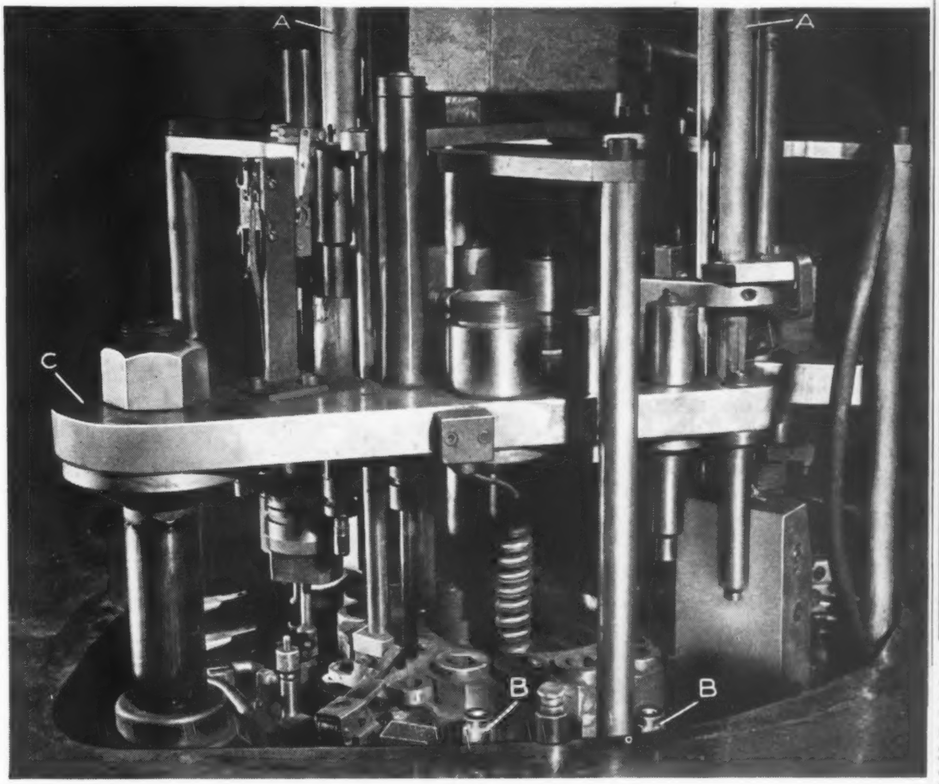


Fig. 10. Automatic Multiple Inspection of the Bore and Outside Diameters of Bushings is Accomplished at the Rate of 4000 per Hour

have been clamped in the desired position, the locating plungers are automatically withdrawn into the cast housings seen above the chucks in Fig. 8.

Valve guide bushings are rough- and finish-bored on these machines at the rate of 380 per hour. The amount of stock removed from each bore diameter is 0.012 to 0.014 inch. The work is rotated at 3600 R.P.M. On the in stroke, the tools are hydraulically fed at the rate of 0.007 inch per revolution, removing about 0.005 inch of stock. On the return stroke, the tool feed is reduced to 0.004 inch per revolution and about 0.007 inch of stock is removed.

Bore diameter is held within $\pm$ 0.0005 inch of the desired size, and the concentricity of the bore with the outside diameter of the bushing is held to within 0.0015 inch total indicator reading. A surface finish of 100 to 200 micro-inches r.m.s. is maintained. Solid tungsten-carbide boring-bars with brazed carbide boring bits are employed. The bars are made only 0.020 inch smaller than the bore of the bushing to insure utmost rigidity. Graduated dials at the front ends of the boring-bar supports permit accurate adjustment of the boring-bar for size.

Some of the valve guide bushings are bored on Hoern & Dilts five-station, double-fixture vertical rotary boring machines of the type shown in Fig. 9. These machines do not lend themselves to automatic feeding, and are therefore loaded and unloaded manually. Cam-fed vertical tool-heads are located above the ten work-spindles. The spindles rotate the work at 2800 R.P.M., and automatically stop at the loading station. Chucks are automatically opened at the loading station by cam-operated push-rods. The non-rotating tools and rotating spindles revolve about the vertical center line of the machine at 12 R.P.M. Bored bushings are unloaded at the loading station seen at the right, and two parts to be bored are loaded by hand in the double-diaphragm chucks. A production of 1400 bushings per hour is obtained from each machine.

As in the horizontal boring machines, 0.012 to 0.014 inch of stock is removed from each bore diameter. In this case, however, practically the full depth of cut is made on the in or down stroke of the tool. Spring-back of the solid tungsten-carbide boring-bar creates sufficient axial pressure to permit the tool to clean up the bore by making a fine finish cut on its return stroke. Bore size is controlled in setting up the machine

(Concluded on page 167)

Progressive Piercing, Punching,

Types of Progressive Dies that have Proved Satisfactory for Both Manual and Automatic Feed — First of Two Articles

A PROGRESSIVE die is one in which a part is completed or partially completed in two or more stages. In designing such a die, the problem is to determine how many stages are required for the part in question, the action that will take place in each stage, and how the stock is to be fed—whether manually or automatically.

Progressive dies can be used with flat strip stock that is sheared to a convenient length for hand-feeding or with coil stock. Coil stock is usually fed automatically into the die by a roll-feed mechanism operated from the press, although it can be fed by hand if desired.

Progressive dies used in conjunction with an automatic feed differ to some extent from those intended for manual feed in that automatic feed requires positive means for disposing of the scrap and removing the part, as well as a different locating system. To provide for this, the number of stages must often be increased. Automatically fed dies are also usually designed with better wearing characteristics, since they are used for parts produced in large quantities and operate in faster presses.

Two-Stage Progressive Dies for Manual Feed

A two-stage piercing, cutting off, and forming die suitable for manual feed is illustrated in Fig. 1. The stock strip *A* is fed between two side guides *B*, fastened to the top of the cutting

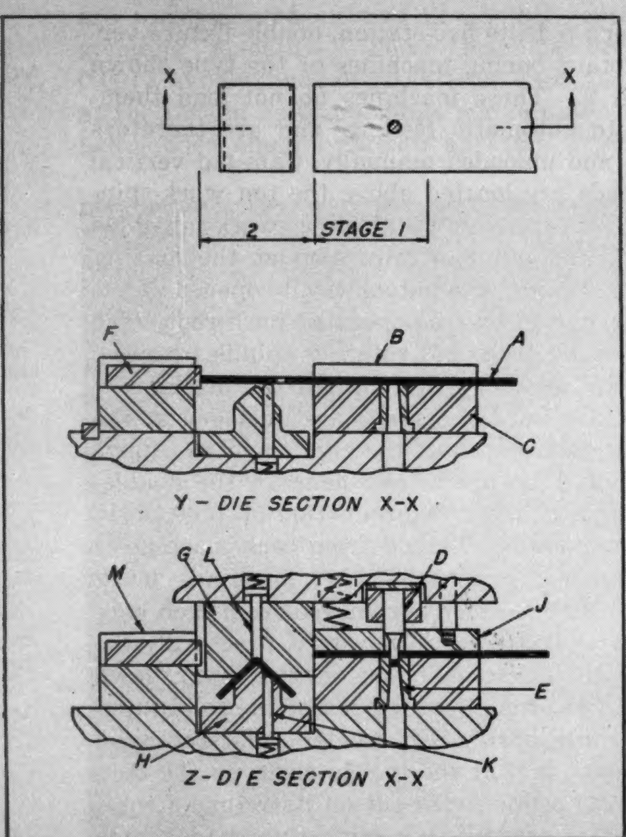
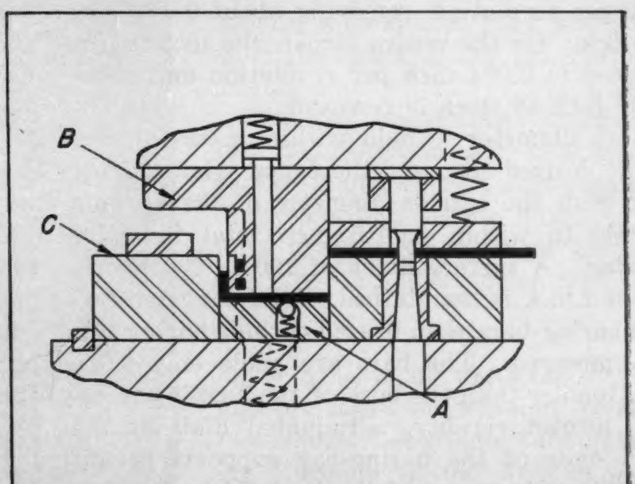


Fig. 1. (Left) This Two-stage Progressive Die Can be Used with Manual Feed for Punching and Forming Angular Parts

Fig. 2. (Below) To Provide More Positive Holding of the Part, and Insure Greater Accuracy, a Pressure-pad A May be Used. This Type of Construction is also Used if the Flange Break Line is Not Straight



and Forming Dies

By CHARLES R. CORY
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die C. In the first stroke of the press, a hole is pierced by the punch D and the die E, and a small piece of scrap is cut off the end of the strip. If the operator feeds the stock flush with or slightly short of the end of die C, no scrap is cut off on the first stroke. For the second and subsequent strokes, the operator feeds the strip against the end gage F. The cutting-off and forming punch G shears the blank from the strip and forms the part against the forming die H.

The spring stripper J strips the stock off the piercing punch D and also prevents it from jumping to the right during the cutting-off operation—an action that might break the piercing punch D. If there were no piercing operation, the spring stripper J and the side guides B could be replaced with a solid stock channel, the cover of which would act as a stripper.

If the part is light, spring stripping devices should be provided in both the forming die and punch to break the oil-film suction and make it easier to release the work. The part can be ejected by an air blast, by using the die in an inclined press, so that the piece slides off the rear, or by using a mechanical ejector. The bottom spring stripper pin K is located on one of the sloping sides of die H, while the stripper pin L can be located at the top of the vee in the punch. The heel plate M takes the thrust of the cutting-off action by bearing against the side of the forming punch G. If the stock is thick, the heel plate and the cutting die C should be backed with a shoulder or key on the die-shoe.

Since the blank can shift during the forming operation, this die is not satisfactory if great accuracy is required; neither can it be used if the break line is not sufficiently straight to permit a solid forming action.

In such cases, a pressure-pad such as shown at A, Fig. 2, in the forming stage of the die should be employed. This spring or air pressure-pad holds the blank against the punch B. As the pad is pushed downward, the flange is formed in an upward direction by the block C; the entire side of the flange must be ironed out by the

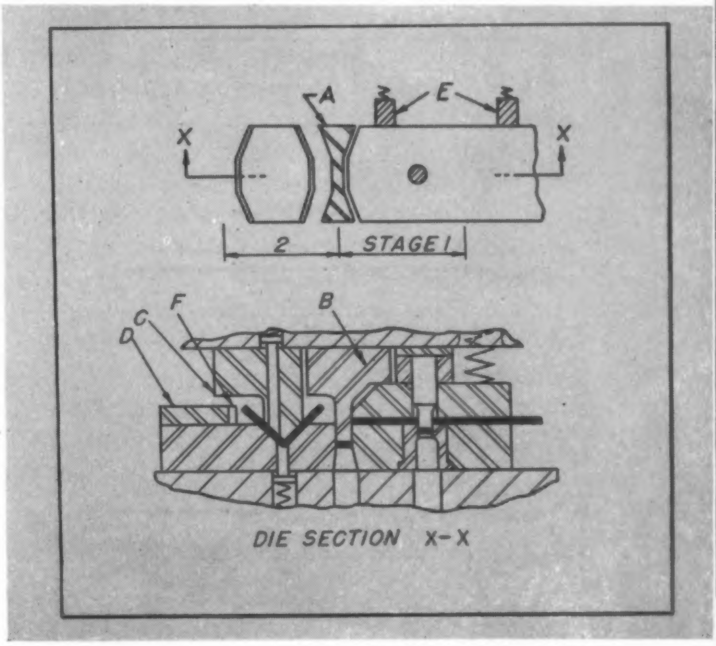


Fig. 3. Type of Progressive Die often Used when the Flanged Edges of the Part are Not Straight. A Punch B Shears out the Curved Section A

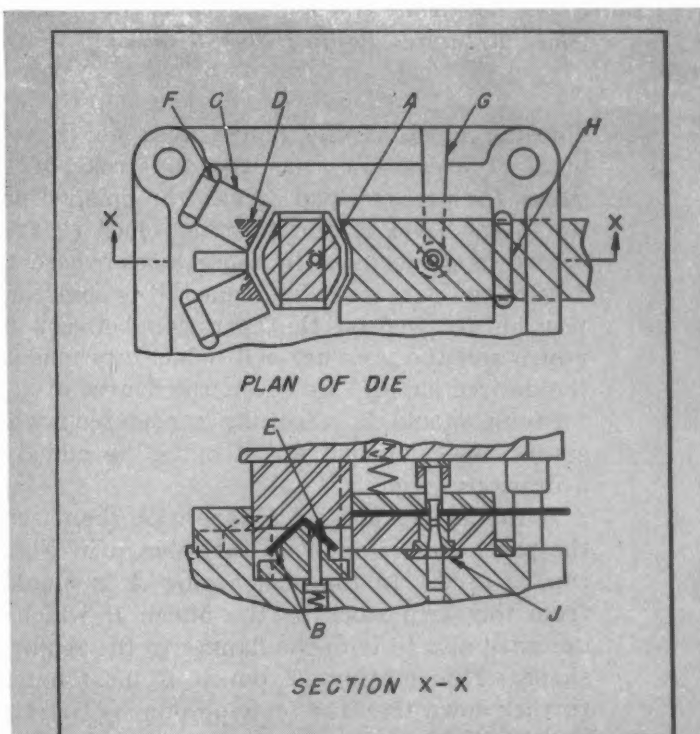


Fig. 4. The Same Type of Part as Shown in Fig. 3 Can be Produced in a Die Similar to the One Here Illustrated. The Punch is Shaped to Shear against the Die-block at A and the Trimming Blocks C

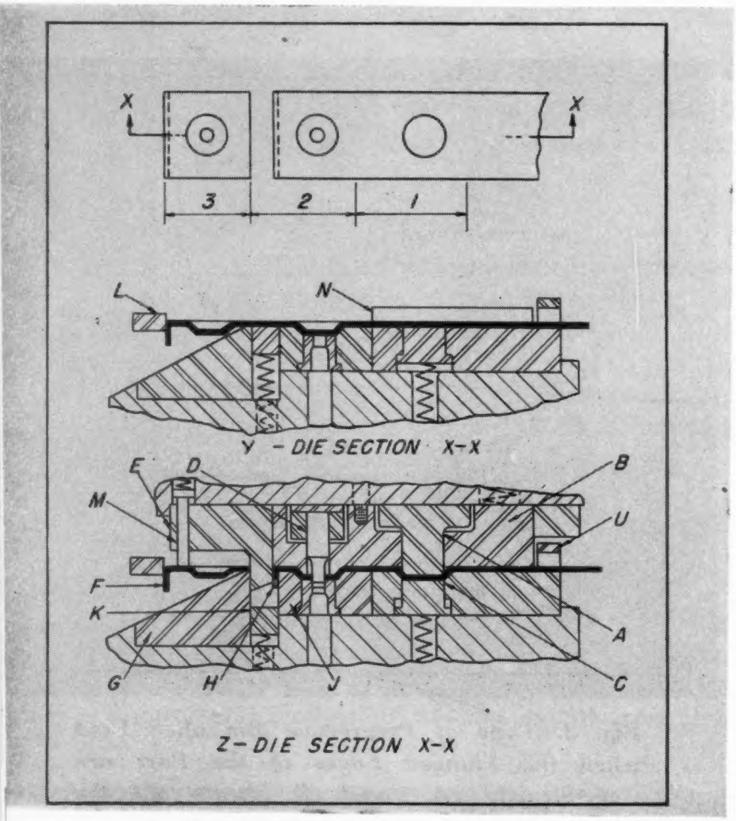


Fig. 5. Three-stage Progressive Die for Forming, Punching, and Cutting off an Angular Part. It is Suited for Use with Automatic Feeding Devices, since it Insures Positive Part Disposal

forming block if the flange does not have a straight break line. On the up stroke of the press, the pressure-pad carries the finished part up to the level of the forming block *C*, from where it is ejected. In those cases where the face of the part must be formed, it is sometimes possible to perform the operation between the punch and the pressure-pad, which are made to the desired shape. However, the degree of such forming should be carefully considered; when severe, the operation might better be added to a previous stage.

If the flanges are not square with the base of the part, a die similar to that shown in Fig. 3 can be used. In this die, a slug *A* is blanked from the strip stock by the punch *B* which is designed also to trim the flanges to the required shape. This cutting-off punch *B* must extend further down than the forming punch *C*, so that the slug is blanked out before the forming operation is started. The V-shaped part is then formed in an upward direction instead of downward, as in the die shown in Fig. 1. No heel plates are necessary with this unit, since it is not subject to unbalanced thrusts. It may be advisable in designing this die, or the others previously discussed, to extend the end gage *D* around the sides of the part, as at *F*, particularly if the part is long. An end gage of this type aids in positioning the stock at the end of the strip when there is only a half inch or so of material left in the side guides at the right of the cutting-off punch. Also, to insure more accurate strip alignment, spring pushers *E*, operating in slots in the side guides, may be provided to keep the strip at the front of the stock channel. Otherwise the stock may assume a diagonal position. These pushers are necessary only if the holes and trim line must be accurately located. They may be used with any hand-fed die.

The same type of part can be produced in a die like that shown in Fig. 4. Here the blank is sheared from the strip on a cut-off line *A*, and the other edge of the blank is trimmed by blocks *C*. This die does not require heel plates unless the part is unsymmetrical in shape, which would cause a forming thrust, or unless the length of the trim line on the left side of the blank is considerably less than that on the right. Keys *F* and *H* may be used to back up the trimming and shearing blocks and thus take excessive thrust off the dowel-pins.

In this unit, the pierced slug drops through the die into an inclined chute *G* at the rear; since this arrangement weakens the die insert, a backing plate *J* is usually added.

Three-Stage Progressive Dies for Automatic or Manual Feed

If stock is to be fed to a die by an automatic roll-feeding device, an air ejection system is usually unsatisfactory. For such applications, a die similar to that shown in Fig. 5 would be used, since it insures more positive part disposal. This is a three-stage die suitable for either automatic or hand feed.

In the first stage, a forming punch *A*, on the down stroke of the press, embosses the stock as it is held flat and free from wrinkles by the spring pressure-pad *B;* on the up stroke, the stock strip is raised out of the pocket by the

spring stripper *C*. In the second stage, punch *D* pierces a hole in the embossed area, and the cutting-off and flanging punch *E* shears off the finished part *F* against the die-block *G* and also forms the flange *H* against block *J*.

The bottom stripper *K* is forced down in advance of this action by spacers attached to the punch-shoe assembly at the front and rear of the die (outside of the stock strip). This stripper is always a sufficient distance below the bottom of punch *E* to clear the flange *H* as it is being formed. If the stock is thick or the flange length is short, so that the flange is stiff enough to depress the stripper as it is being formed, this advance action is not necessary. On the up stroke of the press, stripper *K* moves the flange upward until it is flush with the die-block *G*. The finished part *F* is forced down by the spring pin *M* and slides out along the inclined surface of the die cutting-off block *G*. If the stock is to be fed automatically, the end gage *L* and the spring pin *M* are omitted. Two-way heel plates should be provided, since the thrust to the right resulting from the cutting-off action and the thrust to the left resulting from the flanging operation do not occur at the same time.

Only shallow embossing can be done by the punch *A* of this die, since deep drawing would pull metal in from all sides of the blank, thus causing distortion of the blank in the second die stage. For deeper embossing, relief holes must be punched in the stock strip in a previous stage.

If the die is to be fed manually, two preliminary gages *P* and *Q*, as shown in Fig. 6, are used for gaging a new strip for the first two strokes of the press. Ordinarily, these are in an "out" position, clearing the strip, due to the action of the spring *R*, and are pushed in by the operator to act as temporary end gages during the first and second strokes of the press. The side gage bars *N* and *S* are provided to locate the stock sidewise.

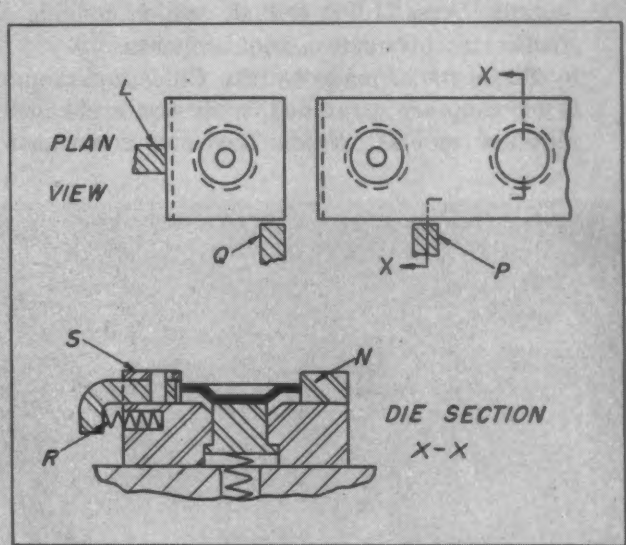
Here, again, if the die is fed automatically, an end gage is not required, since the roll-feeding device feeds the strip the proper distance. However, when great accuracy is required, an extra stage is usually provided. Then the stock is embossed in the first stage and pierced in the second or added stage; in the third stage, the strip is located with a pilot-pin, cut-off, and the flange formed; and in the fourth stage, the finished piece slides off the die. In this case, the relief mechanism of the feeding rolls is used to reduce the pressure of the rolls on the strip during the time that the pilot-pin is entering the pierced hole.

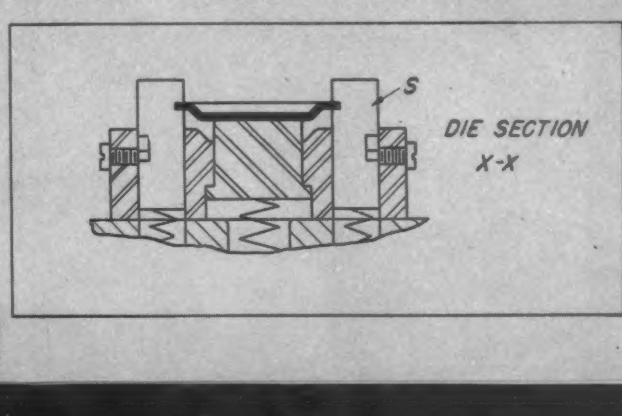
For an automatically fed die, the side guides *N* and *S* in Fig. 6 and the strippers *K* and *C* in Fig. 5 can be replaced with a series of spring pins *S*, placed along the sides of the strip as shown in Fig. 7. If these spring pins are not used, a hold-down bar *U* (Fig. 5) should be provided on the incoming side. This bar keeps the stock flat in spite of the looping action of the coil feeding arrangement.

In the second installment of this article, to be published in a subsequent number of MACHINERY, additional designs of progressive piercing, punching, and forming dies will be described.

Fig. 6. (Upper View) If the Die Shown in Fig. 5 is to be Fed Manually, End Gages P and Q are Used to Locate the Stock for the First Two Operations on a New Piece of Strip Stock

Fig. 7. (Lower View) When Used on an Automatically Fed Die, Grooved Spring Pins S Can be Used to Replace Stock-lifting Devices, Side Guides, and Hold-down Bars





Portable Speed Up

Typical Operations Performed with "Super Cycle" Tools which Operate on Current of High Frequency at Speeds up to 21,600 R.P.M.

By GEORGE H. DeGROAT

POWERFUL, light-weight portable electric tools are used extensively for grinding bare metal, polishing, buffing, and various assembling operations, such as drilling, screw-driving, and nut-setting, in the new General Motors assembly plant at Framingham, Mass. This is one of the latest of the General Motors plants built in various sections of the country for the assembly of Buick, Oldsmobile, and Pontiac automobiles. All of the portable electric tools in this plant are "Super Cycle," running on electric current of 360-cycle frequency at speeds up to 21,600 R.P.M., which considerably facilitates production requirements.

These tools, made by the Chicago Pneumatic Tool Co., are provided with squirrel-cage induction motors, which have no commutators, brushes, or electrical connections between the stator and rotor. The design is, therefore, exceptionally simple, and maintenance costs are low. The tools maintain constant speed under load because of the induction motor. The design also permits unusually light weight. For example, a portable electric Super Cycle drill capable of handling 1/2-inch drills weighs only 6 pounds, and a screwdriver for screws from No. 4 to 10 weighs only 3 pounds.

Super Cycle tools can be operated only on 220-volt, three-phase, 360-cycle current. The required high-frequency current is furnished by eight motor-generator sets located in strategic parts of the plant. Each generator has a capacity of 30 KVA, providing a total capacity of 240 KVA.

Over six hundred Super Cycle tools are used

Fig. 1. Angle Grinders of 4 H.P. Capacity, Operating at 4250 R.P.M., are Used to Remove Excess Welding Bead

360-Cycle Electric Tools Automobile Assembly

in this plant. A typical operation, shown in Fig. 1, consists of grinding the excess welding bead from welded seams on automobile bodies preparatory to tinning and soldering. For this job, angle grinders of 4 H.P. capacity are employed, operating at 4250 R.P.M. Grinding wheels 6 inches in diameter by 1 1/4 inches face width are used with these grinders. The tools illustrated weigh approximately 12 pounds, which is comparatively light for portable tools of this capacity. Being light in weight, they are not tiring to hold and are easy to handle.

To further increase ease of handling, Chicago Pneumatic counterpoises, or balancers, are used to support the grinders in counterbalanced suspension at any level. These may also be seen in Fig. 1, where the tools are shown connected to them by means of ball-bearing suspension bails, which are assembled with the tool. The bails permit free swiveling of the tool without moving the balancer. Rollers riding on an overhead track provide free movement of the balancers along the line in a direction parallel to the conveyor. This arrangement, used throughout the plant wherever the relatively heavier tools are used, relieves the operator of the weight of the tool, thus increasing the speed and efficiency with which it can be used.

Power for the tools is taken from overhead bus-bars which are almost completely enclosed in steel ducts, as shown in Fig. 1. Collector wheels of the trolleys transmit the current through connectors to the tools. Over-running current protection for the motors in the tools is provided at the trolleys, as well as in the plug-in connections on the cords.

Further preparation for tinning and soldering welded seams consists of body scratch grinding. In this operation, wire brushes are used on straight grinders of 4 H.P. capacity, operating at 5000 R.P.M. These tools remove oxide from the welded seams and clean these surfaces to facilitate the soldering operation.

After tinning and soldering in the solder grind booth, sanding disks up to 9 inches in diameter are used on angle sanders to remove excess solder. A 4-H.P. sander, which operates at a speed of 4250 R.P.M., may be seen in the background at the left of Fig. 2. This illustration also shows a rotary file being applied in inaccessible corners of the body. Fig. 3 illustrates the use of a small grinding wheel for the same purpose.

As the bodies progress along the line, many other hand-finishing operations are performed to give the exteriors a smooth surface. In metal finishing to remove ripples and "dings," numerous portable electric tools, such as disk sanders and polishers, are employed. A straight tool with a buffing wheel 6 inches in diameter by 3 inches face width is illustrated in Fig. 4. This

Fig. 2. High-speed Rotary Files are Used for Efficiently Removing Excess Solder from Inaccessible Places

Fig. 3. Running at 5000 R.P.M., This Small Grinder Facilitates Smoothing of Welded and Soldered Sections of Automobile Body Frames

Fig. 4. Scratches are Removed from Automobile Frames with a 4-H.P. Tool which Operates at 5000 Revolutions Per Minute

Fig. 5. By Maintaining Constant Speed under Load, These Angle Polishers Easily Remove "Spray Wave" from Painted Automobile Bodies

4-H.P. tool runs at 5000 R.P.M., and weighs approximately 13 pounds. Conveniently located cradles are available for supporting these tools when they are not in use.

Drilling operations on the various body types are performed with Super Cycle tools as the bodies are processed along the "body-in-white" line. One of these operations is illustrated in Fig. 6, which shows the drilling of large holes in the deck lid, or trunk, of a coupe for outside hinges. A drill jig for accurately locating the holes is quickly secured to the car body by means of fast acting toggle clamps. A 1 1/4-H.P. drill operating at 545 R.P.M. is used for this job. The power of this tool is evident from the illustration, which shows a pressure bar being applied with considerable force for fast drilling. An interesting feature of the balancer arrangement supporting the drill is the freedom of movement provided by the overhead members, which can move both at a right angle and parallel to the direction of conveyor travel.

Some of the many other operations in which these high-frequency tools are utilized include buffing and disk-grinding high spots out of hoods after filing, drilling holes in bodies for the rear window trim, and touching up the chassis with rotary files.

Rustproofing and painting follow the "body-in-white" stage. Fig. 5 illustrates the use of tools for removing the "spray wave" from painted surfaces. In this application, angle polishers of 4 H.P. capacity, running at 1800 R.P.M., are used. Considerable load is applied to the tool, and its ability to maintain constant speed is of great advantage. One of the uses of the balancers for supporting these tools at convenient levels is indicated in the illustration, which shows a second angle polisher within easy reach.

Body polishing is followed by the installation of other items, known generally as trim. Screwdrivers running at speeds of 1000 R.P.M. are widely used in trim-shop operations, where door mechanisms, window glass, windshields, roof liners, and upholstery are installed. These screwdrivers have adjustable clutches, which provide proper torque on the screws for any particular job. In operation, the tool is applied to drive the screw down until the clutch releases under a predetermined load, which is governed by the clutch adjustment.

Fig. 6. Drilling Large Holes in the Deck Lid of a Coupe for Outside Hinges with a 1 1/4-H.P. Drill Running at 545 R.P.M.

Fig. 7. Special Collectors at the Overhead Bus-bar Permit Easy Removal of Tools from One Section of Trim-shop Line to Another

Fig. 8. Nut-runners, Employed on the Final Assembly Line, Facilitate Assembling Remote-control Lever on Oldsmobile Gear Shift

One of the features of the tools in the trim-shop part of the assembly line is the provision for disconnecting the tools from the overhead bus-bars. By turning a disengaging member on a collector, as shown in Fig. 7, the unit can be quickly removed from one section of the overhead bus-bar and inserted at another section where the tool may be required. The collector is designed to contact the three-phase line in only one way, thus preventing reversal of shaft rotation of the tools. In addition, rollers permit free travel of the unit along the bus-bar, parallel to the conveyor line. Attached scabbards provide a convenient support in which to place the tools while not in use.

In Fig. 8 a nut-runner is shown being used in assembling the remote-control lever for the Oldsmobile gear shift. The ease with which these light-weight tools can be located on the work where the part is in a more or less inaccessible position can be readily seen.

Although frequency changers are often used for converting 60-cycle current to 360-cycle frequency, in some cases motor-generator sets, such as are used in this plant, are advantageous. Where voltage fluctuations may occur in a power supply line, variations in the high-frequency line are eliminated by the use of generators. Another advantage of using generators is that the normal load on a power supply line is not further increased by transmission of the power factor of the tools to this line. Furthermore, automatic regulation of the strength of the generator field coils can be made to maintain the desired voltage for the tools.

It may be of interest to note that high-cycle tools, which run at 10,800 R.P.M. on current of 180-cycle frequency, can be conveniently connected to a 360-cycle line and still maintain their normal characteristics. Adding two poles to the stators of high-cycle tool motors permits their use with the higher frequency current.

The Machine Tool Industry and National Defense

THAT machine tools and other metal-working equipment constitute the first line of national defense on the production front is acknowledged by military men and industrialists alike. Machine tools are necessary to produce ordnance materiel, aircraft, submarines, military tanks, and all other implements of modern warfare. Without a large reservoir of modern machine tools, adequate military defense would be impossible in the event of a national emergency.

To provide against such a contingency, the National Security Resources Board has set up a Production Equipment Division under its Industrial Mobilization Plan. The function of this division is to plan specifically for the prompt supplying of machine tools and other metal-working production equipment by manufacturers in the event a rift in international relations appeared imminent. Phantom orders to a total value of $750,000,000 have been issued to machine tool companies alone, and these companies are supposed to hold themselves in readiness to start volume production of the orders at any moment that industrial mobilization becomes necessary. At such a time, the phantom orders would be translated into "pool" orders, which would be expected to meet both military and civilian needs.

Early completion of the large orders that have been planned would be possible only if the machine tool industry were operating at a high rate at the time the orders were actually released. As Alexander G. Bryant, former president of the National Machine Tool Builders' Association, recently pointed out, the machine tool industry has found it necessary to reduce its capacity to one-third of the wartime peak. Machine tool builders have had to let their working forces dwindle, and there are no available reserves of skilled workmen that could be tapped at a moment's notice for rebuilding working shifts to a high production level.

The time to make certain that firms are in a position to handle heavy pool orders is before an emergency threatens. It is the well considered opinion of men who are vitally interested in this matter, from the military and the economic standpoint, that machine tool plants would soon be operating on a high-production basis if the Government made a single change in our tax laws.

This change would be to permit a more rapid amortization of production equipment. Manufacturers of consumer goods could then be induced to replace obsolete equipment with the latest types of machine tools and other metal-working machinery. Consumers would benefit from the lower commodity prices made possible through more efficient manufacture. But more important from a national security standpoint, the machine tool industry would be operated on an active basis, and without any cost to the taxpayers. Even Hitler had the foresight to realize the benefits to German industry of rapid amortization of capital equipment. Only because of complete industrial mobilization was Germany able to fight practically the entire civilized world.

Certainly a democratic nation could afford to tear that one leaf from history!

Charles O. Herb

EDITOR

Heat-Treatment of Tool

To Eliminate Spoilage of Tools and Dies during Heat-Treatment, it is Necessary to Understand the Changes that Take Place in the Steel when it is Heated, Quenched,

IN most cases, the life of tools and dies is proportional to their hardness or toughness. The chief objective of heat-treatment is, therefore, to develop the maximum hardness in the material consistent with the degree of toughness required. A high degree of hardness can be developed in a plain carbon steel by heat-treatment if the steel contains over about 0.50 per cent carbon, provided the section is not very large. But when tools are made in large sections, a plain carbon steel cannot be hardened adequately, and it is necessary to add alloying elements in order to increase the hardenability. The elements usually used for this purpose are manganese, chromium, and molybdenum.

Steel becomes hard during heat-treatment because of the formation of a microstructure called martensite. For some tool applications, the wear resistance provided by the martensitic structure alone is not sufficient, and therefore, tungsten and vanadium, as well as chromium and molybdenum, are introduced into tool steel. These elements combine with some of the carbon in the steel to form very hard particles of carbides, and thus give the heat-treated steel much better abrasion resistance than can be developed without the presence of alloy carbides.

When the tool operates at high speed or under high pressures, or is in contact with hot metal, as in forging, piercing, extruding, and die-casting operations, special tool steel compositions must be used that are resistant to the high temperatures encountered. Vanadium, tungsten, molybdenum, chromium, and cobalt combined with tungsten or molybdenum give the steel the necessary resistance to softening at high temperatures.

Finally, in some applications, the life of the tool or die is more dependent on toughness than on hardness. In such cases, by decreasing the carbon content of the steel or by heat-treating the steel to a lower hardness than the maximum which it can attain, a satisfactory compromise can be established between hardness and toughness. However, if a low percentage of carbon is depended on to provide the desired toughness, the alloying elements chromium and molybdenum must be added to get satisfactory hardenability.

The compositions of tool and die steels that correspond to the foregoing conditions are given in Table 1. While these are only five of the very large group of tool and die steels on the market, they are fairly representative of the essential types. One of these five could be used satisfactorily for practically any application that might be encountered. The many varieties of steels available for tools and dies are justified because each one does some job more efficiently than any of the others.

Steel of the first analysis listed is usually referred to as a plain carbon tool steel, and is also frequently termed a water-hardening or shallow-hardening tool steel. Many modifications of this type of steel are produced to provide small but controlled differences in hardenability. There are also several steels of this type containing small amounts of tungsten, which gives the steel better wear resistance.

The next analysis is characteristic of steels referred to as oil-hardening steels, and differs from the first type primarily in hardenability. Because of its greater hardenability, relatively large tools made of this steel can be hardened by

Table 1. Composition of Five Typical Tool Steels

Type of Steel	Carbon, Per Cent	Manganese, Per Cent	Silicon, Per Cent	Chromium, Per Cent	Vanadium, Per Cent	Tungsten, Per Cent	Molybdenum, Per Cent	Nickel, Per Cent
Plain Carbon Tool Steel...	1.14	0.22	0.16	....	....	....	....	....
Oil-Hardening Tool Steel..	0.85	1.18	0.26	0.50	....	0.44	....	....
High-Carbon High-Chromium Tool Steel	1.55	0.27	0.45	11.34	0.24	....	0.53	....
Molybdenum High-Speed Steel	0.80	0.24	0.29	4.15	1.89	6.64	4.94	....
Chromium-Molybdenum Hot-Work Steel	0.38	0.50	1.08	5.00	0.40	....	1.35	0.30

and Die Steels

By PETER PAYSON
Assistant Director of Research
Crucible Steel Co. of America

and Tempered. This Article, which is the First in a Series of Three, Describes the Heating Cycles for Five Typical Tool Steels and Results Obtained

an oil quench rather than a water quench, which is required for a plain carbon steel. Consequently, tools made from oil-hardening steels do not undergo as much size change and distortion during hardening as those made from plain carbon tool steel.

Steel of the third analysis is referred to as a high-carbon, high-chromium steel or as an air-hardening die steel. It differs from the first two not only in having a much higher degree of hardenability, but also in containing many hard chromium carbides that give it better wear resistance at a given hardness than the first two steels. There are several carbon and chromium variations of this type.

The fourth steel is a high-speed steel; that is, it holds a sharp edge even when the tool is cutting fast enough to cause it to get red-hot. The first three steels, although they could be treated to the same hardness, would fail very rapidly under such high-speed cutting conditions because they would become soft when heated to a dull red color. There are many varieties of high-speed steels: Some contain more tungsten and less molybdenum than given in the table; others contain more vanadium; and still others have up to 12 per cent cobalt. The type listed in the table was selected because it is an economical general-purpose steel.

The last steel generally is referred to as a hot-work steel or a chromium-molybdenum hot-work steel. It is used where the tool is in intimate contact with hot metal, as in forging, extruding, or die-casting operations. Even though it has a relatively low carbon content compared with the other alloy steels, it has a higher hardness than the first two steels when heated to about 1100 degrees F., and therefore will wear better on hot-work jobs. The high-carbon, high-chromium steel and the high-speed steel will also be wear-resistant at 1100 degrees F., but they will be less tough than the hot-work steel.

How Heating Changes the Structure of Tool Steel

The first step in the heat-treatment of steel is the heating. The purpose of the heating is to form austenite and to dissolve carbon in the austenite. The solution of the carbon is necessary so that in the second step of heat-treatment, when the transformation of austenite takes place, the steel will develop the desired hardness. It is important to remember that even though a large amount of carbon is in the steel, it is not effective in developing hardness unless it is first dissolved in the austenite.

Fig. 1 shows the relationship between the attainable hardness and the carbon content. The hardness increases rapidly up to 60 Rockwell C as the carbon increases to 0.40 per cent. From this point on, the hardness increases gradually to 65 Rockwell C as the carbon increases from 0.40 to 0.70 per cent. Above about 0.70 per cent carbon, the hardness remains practically constant. For maximum hardness in the steel, therefore, approximately 0.70 per cent carbon must be dissolved in the austenite. All of the steels being discussed except the chromium-molybdenum hot-work steel have sufficient carbon in the analysis to attain a hardness of 65 Rockwell C.

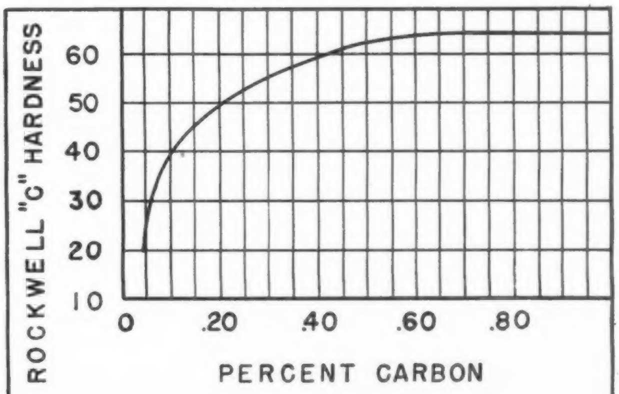


Fig. 1. The Hardness That Can be Imparted to a Steel Depends to a Large Extent on the Amount of Carbon Present. The Attainable Hardness Remains Practically Constant as the Carbon Content Increases beyond 0.70 Per Cent. (Courtesy American Society for Metals)

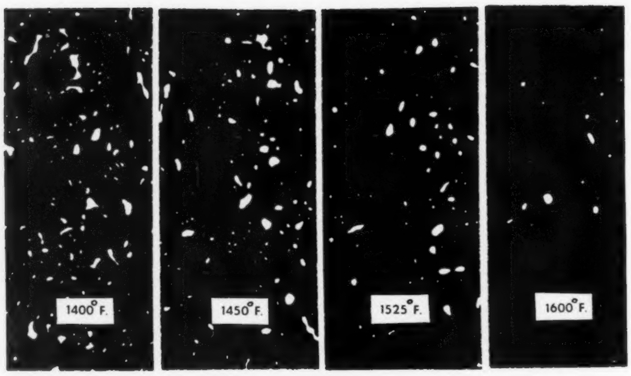


Fig. 2. The Progress of the Solution of Carbon in a Plain Carbon Tool Steel is Shown at Various Temperatures in These Photomicrographs. The White Particles are the Carbides that have Not Dissolved

Even though the carbon is in the steel, it is not necessarily all dissolved in the austenite. This is probably best explained by Figs. 2 and 3. In Fig. 2 are shown photomicrographs of the 1.14 per cent carbon tool steel after being heated to 1400, 1450, 1525, and 1600 degrees F.; quenched to preserve the condition of the carbides at the heating temperature; and tempered at a low temperature. The white particles in the photomicrographs are undissolved carbides. At 1450 degrees F. there are fewer carbides than at 1400 degrees F. At 1525 degrees F. and at 1600 degrees F. there are still fewer undissolved carbides. The amount of carbon dissolved in the austenite is therefore greater at 1450 degrees F. than at 1400 degrees F., and still greater at 1600 degrees F. But even at 1600 degrees F. all of the carbon in the steel is not dissolved in the austenite.

The solubility of carbides is not the same in all steels. The explanation for this is in the composition of the austenite and of the carbides. For example, in carbon steel, the austenite is practically all iron, and the carbide is a compound of iron and carbon. In high-speed steel, the austenite contains chromium, tungsten, molybdenum, vanadium, and iron; and the carbides are compounds of carbon, vanadium, tungsten, molybdenum, chromium, and iron. The solution of carbides in high-speed steel increases with increasing temperatures, as in carbon steel, but a considerable amount is still present at 2100 degrees F., as illustrated in Fig. 3, which shows photomicrographs of a high-speed tool steel of the composition given in Table 1. Even after this steel is heated to 2250 degrees F., many carbides remain undissolved in the austenite.

The effect of the solution of carbides on the hardness of the high-speed steel, as quenched, is shown in Table 2. This steel hardens appreciably when quenched at 1600 degrees F., but it does not reach maximum hardness until it is quenched at about 2100 degrees F. The recommended temperature to which this steel should be heated before quenching however, is 2250 degrees F. The reason for this will be made clear later in a discussion on the effects of tempering. At least it is apparent that this steel must be heated well above its critical temperature (1530 degrees F.) before enough carbides are dissolved to obtain full hardening.

Table 2. Effect of Heating Temperature on Hardness of Tool Steel

Austenitizing Temperature, Degrees F.	Rockwell C Hardness	
	Molybdenum High-Speed Steel	High-Carbon High-Chromium Steel
1600	53	50
1800	60	64
1950	64	59
2100	66	36
2250	65.5	..

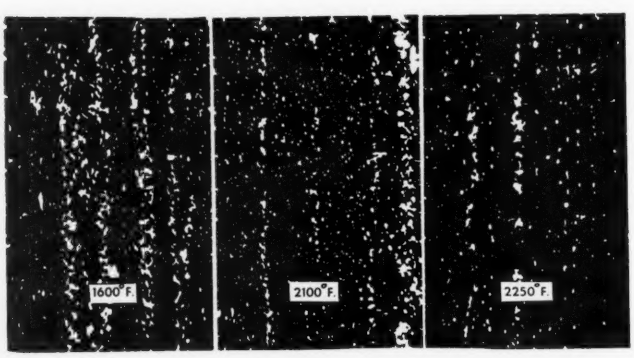


Fig. 3. The Amount of Carbon that is Dissolved in Austenite Varies with the Composition of the Steel. Molybdenum High-speed Steel Must be Heated to Approximately 2250 Degrees F. before a Sufficient Amount of Carbon Goes into Solution

Fig. 4. Double Hardening of a High-speed Steel Results in Coarsening of the Grain, as Shown. If Reheating after Hardening is Necessary, the Steel Should be Annealed to Prevent the Formation of Large Grains

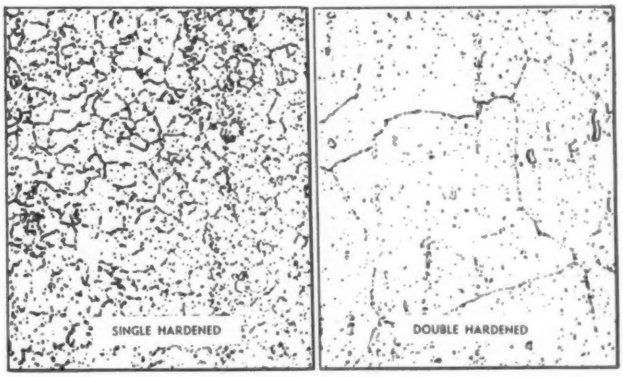


Table 2 also illustrates another point, which is that when too much carbon is dissolved in the austenite structure of some steels, the steel is softer rather than harder. The high-carbon, high-chromium tool steel is capable of attaining its maximum hardness of 64 Rockwell C when it is heated to 1800 degrees F. At higher temperatures, more carbides dissolve, and the resultant hardness of the steel when it cools is less, owing to the fact that the high-carbon austenite does not transform to martensite when the steel is cooled, but remains as austenite at room temperature. Since austenite is much softer than martensite, the steel is softer.

Grain Size and Melting of Steel

Two other factors are involved in the heating of tool steels besides the formation of austenite and the solution of carbides. These are grain coarsening and melting of the steel. In tool steels, the grain size should be as small as possible, because a fine-grained hardened steel is inherently tougher than a coarse-grained steel. Usually there is little concern about coarse grain in a tool because coarsening of the grain does not occur until the temperature is well above the usual austenitizing temperatures.

The first two steels listed in Table 1 coarsen appreciably at temperatures as low as 1600 degrees F., but the high-speed steel still has a fine grain at 2250 degrees F. However, a startling grain coarsening occurs in high-speed steel when it is reheated to the high temperature for a second time, as shown in Fig. 4. The tremendous grains in the structure at the right produced by "double hardening" cause the fracture of the steel to have a fishscale appearance, and tools are generally very brittle when treated in this manner. If, for some reason, a high-speed tool has to be hardened a second time, it should be annealed fully before the second hardening. This annealing between hardenings prevents the formation of large grains.

There is very little risk of melting steel during heat-treating, except in the case of high-speed steel. The molybdenum high-speed steel begins to melt at about 2275 degrees F., and there is definite evidence of melting at 2300 degrees F. This is indicated by the formation of a massive carbide network at grain boundaries. Such a structure decreases the toughness of high-speed steels.

Melting temperatures vary with the compositions of high-speed steel, and the well-known high-tungsten high-speed steels do not begin to melt until they are heated to about 2400 degrees F. or higher. Any increase of carbon at the surface of the steel brought about by contact of the steel with carbonaceous materials at the high austenitizing temperatures used for hardening lowers the melting temperature of the steel.

It is apparent from the foregoing that the changes occurring in heating control, to a large extent, the ultimate hardness of a tool or die steel. During heating, austenite forms and carbides go into solution, the degree of solution be-

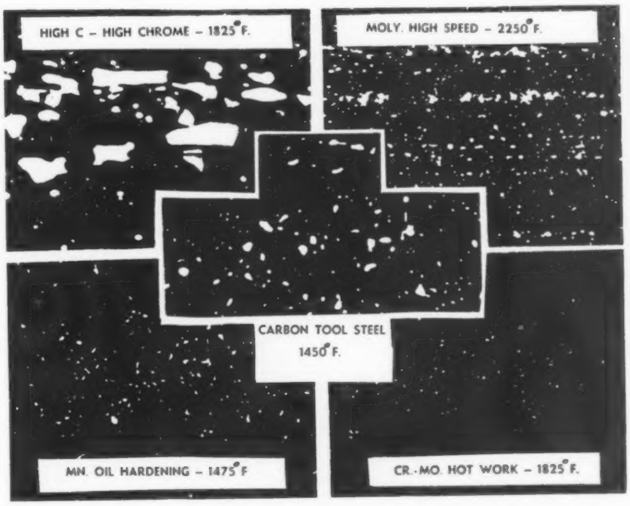


Fig. 5. The Condition, after Usual Heating, of the Five Steels Listed in Table 1 is Shown in These Photomicrographs. The Residual Carbides Indicated by the White Spots Contribute to the Wear Resistance of the Hardened Steel

ing dependent on the composition of the steel and on the heating temperature. Heating should be at a high enough temperature so that a sufficient amount of carbon is dissolved to give the steel a high attainable hardness. However, in practically all tool steels, there are many undissolved carbides at the usual heating temperatures.

The conditions of the five steels listed in Table 1 when heated ready for hardening are shown in Fig. 5. These photomicrographs represent longitudinal sections of relatively small sized bars at an original magnification of 1000 X. The residual carbides shown contribute appreciably to the wear resistance of the hardened steel, the massive carbides in the high-carbon, high-chromium steel accounting for the advantage of this steel over the plain carbon and manganese oil-hardening steels for such applications as blanking dies.

Overheating may cause tool failure. In the case of an oil-hardening or a plain carbon tool steel, overheating causes the grain to coarsen and the steel to become brittle; with a high-carbon, high-chromium type steel, too high a heating temperature causes an excessive amount of austenite to be retained on cooling; and in the case of high-speed steels, melting may occur.

Finally, the length of time that the steel is held at the required temperature determines the amount of carbon that goes into solution. The longer the heating time, the more complete the solution. Naturally, the larger the piece of steel, the longer is the time necessary to heat it. Usually, a quarter of an hour per inch of thickness is sufficient, although some people recommend as much as an hour per inch of thickness. At very high temperatures, such as those used for high-speed steel, the time for heating is usually shorter, being about two to five minutes per inch of cross-section.

The second article in this series, which will be published in February MACHINERY, will discuss the quenching of tool and die steels.

Influence of Steel Hardness in Face-Milling

FACE-MILLING tests on seven different kinds of steels having hardnesses of about 200, 300, and 400 Brinell, made to determine the power consumption and tool life, were reported in a paper presented before the recent annual meeting of the American Society of Mechanical Engineers by J. B. Armitage, vice-president, and A. O. Schmidt, research engineer, of the Kearney & Trecker Corporation, Milwaukee, Wis.

Differences in the power required to face-mill the various steels, each having the same hardness, were comparatively small, but the tool life varied considerably. In general, the harder a steel is, the greater will be the work required to machine it and the shorter the tool life if set-up conditions, cutting speed, and feed are the same as those used for identical, but softer, steels.

When production or tool-life tests are unavailable, the hardness of the steel can be taken as a guide in choosing the cutting speed and feed. A reduction in the cutting speed and the use of a finer feed will increase the tool life when milling harder steels. Machine rigidity and optimum cutter design become increasingly important when machining harder steels.

Hard steels are usually milled with carbide cutters at speeds between 150 and 300 feet per minute, with a feed per tooth of 0.003 to 0.010 inch. For mild steel (not harder than 200 Brinell), a cutting speed of 350 to 800 feet per minute, with a feed per tooth of 0.010 to 0.020 inch, is generally recommended. Medium-hard steels, which would include steels around 300 Brinell hardness, should be milled at 250 to 400 feet per minute, with a feed per tooth ranging from 0.007 to 0.015 inch. Speeds in the upper part of a recommended range and feeds in the lower part should be chosen for a finishing cut, while the opposite procedure should be used for roughing.

Heating a piece to about 1500 degrees F. will decrease the power requirements appreciably. While the heating will result in changes in microstructure and accuracy of the work, a difficult milling job can be made easier this way. Care must be taken to provide proper protection against heat flow from the work to the machine, either by insulation or by circulating coolant through the machine table or fixture.

* * *

Any equipment manufactured from iron or steel is confronted, from the moment of fabrication, with a battle against the destructive effects of wear when in use and of corrosion when idle. Wear can be minimized by proper lubrication of all moving parts, but corrosion must be guarded against, not only while the equipment is in use, but especially when it is temporarily idle or in storage.—*Lubrication*

Automation—An Outstanding Method of Increasing Production

(Continued from Page 151)

by graduated dials shown at the top of the tool-heads. When the dials are rotated, the carbide boring bits are moved a distance corresponding to the graduations by pivoting of the tool-heads.

Following this operation, the valve guide bushings are again washed and then automatically inspected at the rate of 4000 per hour on the electronically and mechanically controlled multiple machine seen in Fig. 10. Completely machined, clean bushings fall from an overhead conveyor into vertical loading tubes *A*, which deposit them, as shown at *B*, in holders on a rotary indexing table of the inspection machine. Both maximum and minimum limits of all critical dimensions on the bushing are checked as the part is indexed through an angle of 180 degrees. Carbide-tipped fingers and anvils on side-acting gage-heads inspect the outside diameters of the bushings for size and taper, and vertical-acting carbide-tipped plug gages, mounted on reciprocating slide *C*, inspect the bore for size, out-of-roundness, and taper. Groove width and position are checked at another station, as well as length of the part, and concentricity between the bore and outside diameter.

Parts within limits ($\pm$ 0.0005 inch on the bore and $\pm$ 0.00025 inch on the outside diameter) are automatically ejected onto another conveyor, while over-size or under-size bushings slide into a "reject" bin. A visual inspection is also made at this point to detect pits, porosity, or blow-holes that may have been uncovered during machining. Satisfactory bushings are phosphate-coated, 0.0002 inch thick, for corrosion resistance and to facilitate breaking in of the engine. An automatic dip type machine is employed for this purpose. The trays of bushings are dipped into various liquid compartments and travel in an oval course around the machine. Coated bushings are automatically emptied into light sheet-aluminum shipping trays.

Increases in production ranging up to 20 per cent have been realized by the application of Automation to press operations and to the production of valve guide bushings. Investigation is being made of the possibility of applying this method to many other parts, with special attention to cases where feeding, material-handling, and unloading require a large share of the production time. By means of Automation, labor is freed for set-up, maintenance, or supervisory work, where it is urgently required due to the manpower shortage.

Manual of Mathematics for Engineers and Shop Men

MATHEMATICS AT WORK. By Holbrook L. Horton. 728 pages, 6 by 9 inches; 196 drawings and diagrams. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, $6.

This book is a working manual intended for machine designers, tool engineers, gage designers, mechanical draftsmen, technical or trade school students, and teachers. The practical applications of arithmetic, algebra, geometry, trigonometry, and logarithms are illustrated by a wide variety of mechanical problems taken from actual practice. These problems are analyzed and solved in an easy-to-follow, step-by-step procedure.

The classification of problems is mathematical; that is, problems illustrating some common mathematical principle or method have been grouped together. This classification makes it easy to find the general type of problem at hand or one closely paralleling it; hence it is possible to apply the manual to a much broader range of problems than might be at first apparent.

A reference section consisting of five chapters provides a concise but clear review of the practical fundamentals of arithmetic, algebra, geometry, trigonometry, and logarithms, so that where basic principles or formulas are used in the problem solutions they can be immediately referred to if necessary.

Methods of solution that are a frequent source of difficulty have been explained in detail. The reason for using approximate formulas and the way in which they are applied is one example. The step-by-step procedure in applying trial-and-error solutions is another. The use of empirical or "working" formulas is also discussed, and a variety of problems are presented to show how such formulas are applied. A chapter on refresher questions in mathematics, mechanics, and strength of materials is included to clarify troublesome points frequently encountered in the solution of mechanical problems.

To round out the book as a complete working manual, 145 pages of standard mathematical tables, including logarithmic and trigonometric tables, are included.

Taken together, the review of mathematical fundamentals, the comprehensive discussion of problems and their solutions, the explanation of special aids in computation, and the many tables of useful data make this manual an indispensable working tool for all who are engaged in the mathematical solution of mechanical problems.

Spinning Large Diffuser

Typical Operations in the Production of Parts of Air Diffusers Used in Distributing Air in Industrial Air-Conditioning Systems — Making

Fig. 1. (Above) Turning Large Maple Chuck for Supporting Aluminum Blanks during Spinning Operations is the First Step in Manufacturing Air Diffusers for Air-conditioning Systems

Fig. 2. (Above) Cone Blanks of the Required Diameter are Cut from Square Aluminum Sheets on a Rotary Shear

Fig. 3. (Left) A Large Aluminum Disk is Mounted on the Chuck of a Lathe preparatory to Spinning a Cone. The Sizes of the Cones Range from 2 Inches to 7 Feet in Diameter

Aluminum Air Cones

Chucks, Cutting Blanks, Spinning, and Checking the Spun Part at the Hartford, Conn., Plant of the Anemostat Corporation of America

Fig. 4. (Above) Spinning a Cone that will Serve as One of the Units in an Air Diffuser. As Cones are Made in a Wide Range of Sizes, Spinning is an Economical Production Method

Fig. 5. (Above) Templets are Used to Check the Contours of Aluminum Cones at Completion of Spinning Operation

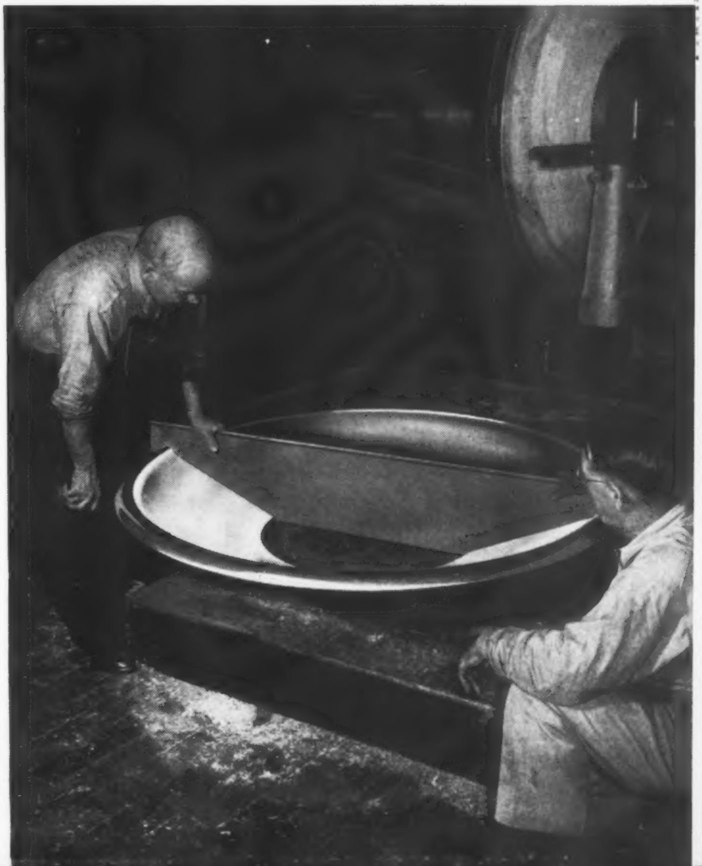


Fig. 6. (Right) Quality Control is Important, as the Efficiency of the Air Diffuser Depends Largely on the Accuracy of the Cone Contours and their Relationship to One Another

A.S.M.E. Discusses Wide Range of Subjects at Annual Convention

THE sixty-ninth annual meeting of the American Society of Mechanical Engineers, held in New York November 28 to December 3, inclusive, was marked by the wide diversity of subjects discussed in the papers presented at the seventy-two technical sessions. Nearly two hundred papers were read dealing with practically every branch of mechanical engineering. The unusual interest aroused by this comprehensive program was evidenced by the fact that the registration for the 1948 convention was one of the largest in the history of the Society.

James M. Todd, Newly Elected President of the American Society of Mechanical Engineers

One of the most outstanding papers presented at the production engineering sessions dealt with the great savings in time effected by the application of what is known as "Automation" to the manufacture of guide valve bushings. The term "Automation" was coined by the Ford Motor Co. to denote the automatic handling of parts in the process of manufacture, and this paper was read by Nevin L. Bean, director of production engineering for the Highland Park Operations of the Ford Motor Co. Details of this outstanding method of increasing production are given in the leading article of this issue of MACHINERY.

Another interesting paper read at the production engineering sessions was "Manufacture of the Triclad Motors," by P. Lebeubaum, Motor Engineering Division of the General Electric Co. The subject of thermit welding was discussed by J. H. Deppeler, consulting engineer for the Metal & Thermit Corporation. He described the procedure to follow in making a thermit weld and the application of the process to the welding of heavy pieces.

A technical session on metal cutting was presented under the auspices of the Research Committee on Metal Working Data, with Fred W. Lucht, development engineer of the Carboloy Company acting as chairman. Tests to show the power consumption and tool life in face-milling seven different kinds of steel having hardnesses of approximately 200, 300, and 400 Brinell were described in a paper presented by J. B. Armitage, vice-president, and A. O. Schmidt, research engineer, of the Kearney & Trecker Corporation, Milwaukee, Wis.

An analysis of the discontinuous type of chip, consisting of segments formed by rupture occurring intermittently on the shear plane as the cutting tool progresses, was formulated in a paper presented by Michael Field, applied research director of Metcut Research Associates, and M. E. Merchant, senior research physicist of the Cincinnati Milling Machine Co., Cincinnati, Ohio.

F. W. Boulger, H. L. Shaw, and H. E. Johnson, of the Battelle Memorial Institute, Columbus, Ohio, described a testing method which evaluates the machinability of free-cutting steels on the basis of the feed obtained when a predetermined tool pressure is used for lathe cutting.

Included in the many valuable papers presented at the machine design sessions were: "Roller Chain Designs and Their Engineering Applications," by Joseph Joy, manager, engineering sales, General Chain & Belt Co., New York; "A Simplified Fine-Pitch Worm-Gearing Standard," by Louis D. Martin, gear engineer, Eastman Kodak Co., Rochester, N. Y.; "Plain Bearings—Today and Tomorrow," by Edwin Crankshaw, assistant chief engineer, Cleveland Graphite Bronze Co., Cleveland, Ohio; and "The Mechanical Seal— Its Construction, Application, and Utility," by Carl E. Schmitz, vice-president and director of engineering, Crane Packing Co., Chicago, Ill.

At one of the railroad sessions a symposium

was held on non-destructive testing of parts and assemblies. Magnetic particle testing was discussed by L. B. Jones, consulting engineer, Paoli, Pa.; fluorescent-liquid inspection by Ray McBrian, engineer of standards and research, Denver & Rio Grande Railway Co., Denver, Colo.; and ultrasonic materials testing by H. E. Van Valkenburg, development engineer, General Electric Co., Schenectady, N. Y., and Daniel E. Farmer, electrical engineering supervisor, Sperry Products, Inc., Danbury, Conn.

Several industrial motion pictures were shown at the convention. Among these were the following: "This is Aluminum," produced by the Aluminum Co. of America; "This is Steel" and "Making of Alloy Steel," Bethlehem Steel Co.; "Man-Au-Trol," the Bullard Co.; "Materials Handling," General Electric Co.; "Tooling for Jet Propulsion," Lapointe Machine Tool Co.; "Electronics at Work," Westinghouse Electric Co.

At the annual dinner, held on Wednesday night, December 1, the retiring president, E. J. Bailey, spoke on engineering opportunities in industry. He emphasized the fact that American industry and engineering can lead the world toward a solution of its human relation problems as they have led it through technical and economic progress toward a higher standard of living.

Following the dinner, a reception was held for the newly elected president, James M. Todd, consulting engineer of New Orleans, La. Mr. Todd has held the offices of manager and vice-president of the American Society of Mechanical Engineers, and became a Fellow of the Society in 1944. He was graduated from Tulane University in 1918 with the degree of B.E. and in 1930 received his M.E. degree. During World War I, he served in England and France as a Lieutenant of Engineers.

Pay Incentive Plans Studied by Tool and Die Manufacturers

PAY incentive plans for contract tool and die shops were considered at the third national convention of the National Tool and Die Manufacturers Association, held in Milwaukee November 14 to 17, inclusive. The discussion was opened with a paper presented by S. A. Peck, executive vice-president of the Trundle Engineering Co., consulting management engineers, who reported on studies made in a contract tool and die shop and outlined recommendations for establishing incentive plans in such shops.

Officers of the Association for the coming year were elected as follows: President, J. J. Kohl, president of International Tool Co., Dayton; first vice-president, Centre W. Holmberg, president of August W. Holmberg & Co., Inc., New York City; second vice-president, R. H. Cope, manager of Bunell Machine & Tool Co., Cleveland; treasurer, J. H. Stanek, treasurer of Stanek Tool & Mfg. Co., Milwaukee; and secretary, Alfred Reinke, vice-president of Gus Reinke Machinery & Tool Co., Hillside, N. J.

New Officers of National Tool and Die Manufacturers Association. (Reading from Left to Right) J. H. Stanek, Treasurer; Alfred Reinke, Secretary; R. H. Cope, Second Vice-president; Centre W. Holmberg, First Vice-president; J. J. Kohl, President

Engineering News

Electric "Hot Topping" Technique Improves Steel Manufacture

Electric "Hot Topping" is a technique for supplying heat by means of an electric discharge to the top of a metal ingot covered by a protecting blanket of flux. As a result, a cone-shaped reservoir of molten metal is continuously maintained at the top of the ingot. This reservoir feeds molten metal to the solidifying metal directly beneath it and prevents the formation of cavities and other defects as volume changes take place due to solidification.

The patented process, available under license from the M. W. Kellogg Co., Jersey City, N. J., has been applied to the commercial manufacture of a wide variety of steels and high-temperature alloys. By minimizing the formation of "pipe," cropping of the ingot and remelting of defective metal have been greatly reduced, resulting in important savings.

Aluminum Tanks Welded Rapidly by the Heliarc Process

Aluminum fuel tanks requiring approximately 40 feet of welding in their fabrication were completed in about 1 3/4 hours by means of the Heliarc inert gas-shielded arc-welding process. Cleaning and corrosion-treatment operations, specified for all surfaces inside the tank affected by welding, were eliminated because the welds were clean, smooth, and non-porous, and contained no corrosive flux inclusions.

Because of the rapid welding rates possible, transfer of heat to the surrounding metal was small. Warpage was therefore held to a minimum, and it was possible to assemble the tanks without the aid of jigs. The tanks were fabricated from 10-gage (0.1345 inch), 3S-1/2H aluminum sheets, with wear plates 1/4 inch thick, 8 inches wide, and 50 inches long welded to the bottom of the tank. High-frequency alternating current varying from 80 to 150 amperes and filler rods containing 5 per cent silicon were employed.

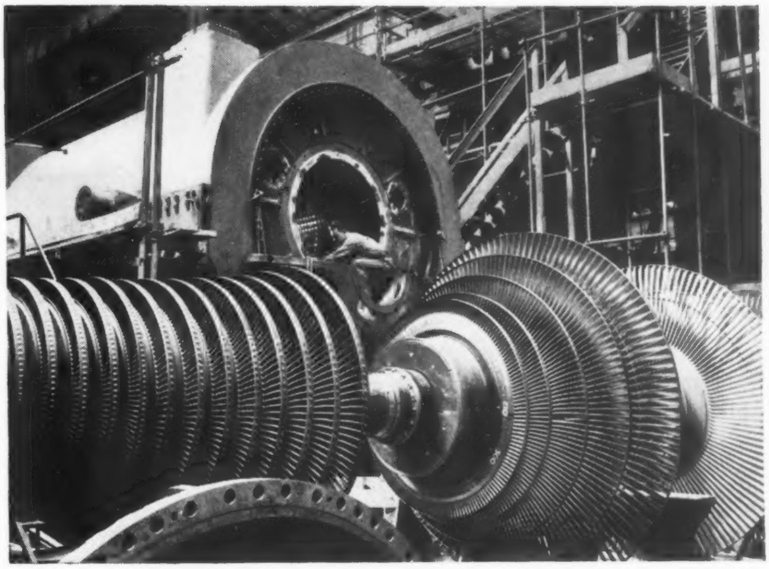
Portable Industrial "Seismograph" Records Vibration

A new portable "seismograph" that will analyze vibrations with frequencies as low as two cycles per second has been developed through the collaboration of the Westinghouse Electric Corporation, Baltimore, Md., and the Barry Corporation of Cambridge, Mass. The heart of the new instrument is the Westinghouse Vibrograph which, mounted in a Barry frame, provides a means of recording vibration when there is no steady reference point, as in swaying buildings.

The instrument, which is about the size of an ordinary box camera, embosses a permanent

Aluminum Fuel Tank Requiring 40 Feet of Welding in Its Fabrication was Completed in 1 3/4 Hours by the Heliarc Process. Photograph Courtesy of The Linde Air Products Co.

Assembling a 100,000-kilowatt Turbine-Generator Set for Testing at the Turbine Plant of the General Electric Co., Schenectady, N. Y. This Equipment was Built for the Public Service Electric & Gas Co., Sewaren, N. J. Tip Speed of the Last-stage Wheels of the 35-foot Long, 70,000-pound, 23-stage Turbine Rotor (Foreground) is About 1390 Feet per Second —Well above the Speed of Sound. Stator Frame (Background) will House Generator Rotor Weighing 75,200 Pounds. When Assembled, the Complete Unit will be Approximately 85 Feet Long



record of vibrations on a transparent film. It records vibrations over the range of 600 to 15,000 cycles per minute, with amplitudes as low as 0.0001 inch or as great as 1/16 inch.

The Barry seismic pendulum provides a Vibrograph support whose natural frequency is lower than the frequency of the vibration to be measured. The Vibrograph thus tends to remain stationary. The pendulum consists of a triangular arm supported from a vertical column by means of frictionless elastic hinges. The low natural frequency is attained by mounting the Vibrograph relatively close to the hinges and setting a large mass in a pan at the free end of the arm. The Vibrograph includes a prod that contacts the structure whose vibration is to be measured.

The first application of this instrument has been made in measuring the vibration of walls in a textile mill. Because of its compactness and portability, the instrument should also be useful in analyzing vibration of machinery.

Quartz Crystals Produced by a Synthetic Process

Sparkling crystals of real quartz are now being grown inside bomblike steel "test tubes" by a group of scientists at the Bell Telephone Laboratories. The material from which the quartz crystals are grown is a finely powdered form of silica. This is placed in the bomb and an aqueous alkaline solution is added.

A seed plate, consisting of a thin sheet of quartz, is suspended at the top of the bomb. The bomb is then sealed and placed in a furnace. Under pressures exceeding 15,000 pounds per square inch and at temperatures of about 750 degrees F., the silica dissolves. In its dissolved state, it rises to the cooler part of the bomb and is deposited on the seed plate until all of it is in the form of a single clear crystal.

Multibillion-Volt Synchrotron to be Built

The United States Atomic Energy Commission will finance the construction of a 30-foot multibillion-volt proton synchrotron or high-energy electronuclear machine to be built at Brookhaven National Laboratory, Upton, Long Island. Construction of the accelerator, the largest in the East, will take approximately three years. The new machine will produce, under controlled laboratory conditions, high-energy protons, the primary cosmic particles which constantly penetrate the earth's atmosphere. By causing these high-energy protons to bombard hydrogen atoms, for example, it will be possible to produce both light and heavy mesons in the same manner as these particles are made by cosmic rays.

Navy to Construct a 65,000-Ton Airplane Carrier

The Navy is planning to construct a 65,000-ton carrier that will carry more than a score of 100,000-pound four-engined planes, will have a speed of about 33 knots, and will displace about 80,000 tons with full load. The new super-carrier will have an armored flight deck. Its high-pressure, high-temperature boilers will supply steam turbines capable of producing about 280,000 H.P. The overall length will be 1090 feet, and the beam 130 feet.

Computing Offset for Machining Rake Angle on Milling Cutters and Reamers

By D. WEST

IN the cut-and-try method of fluting reamers and milling cutters, radial teeth—that is, teeth without rake when measured with reference to a radial line—are obtained by setting the cutter to graze the highest point on the work and then, after removing the work, aligning the small-angle side of the fluting cutter with the index-centers by using a straightedge.

To obtain a rake angle with reference to the radial line on a milling cutter or reamer, the work must be offset so that the cutter is either ahead of this radial position (for negative rake) or behind (for positive rake). In Fig. 1, the double-angle cutter is shown ahead of the radial-line position, ready to cut a flute or tooth having negative rake. In Fig. 2, the cutter is behind the radial-line position, ready to cut a flute or tooth having positive rake. The amount of horizontal offset of work with relation to fluting cutter, as measured from the radial position, is designated *st* in both cases. The object is to establish a formula for *st* in terms of the known values, which are: Small angle *A* of fluting cutter; rake angle *B* to be produced in milling cutter or reamer; and radius *op* of cutter or reamer blank.

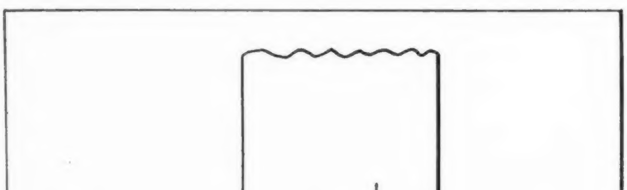


Fig. 1. Position of Fluting Cutter for Producing Negative Rake Angle B is Distance st ahead of Radial Position Shown by Dotted Line ot

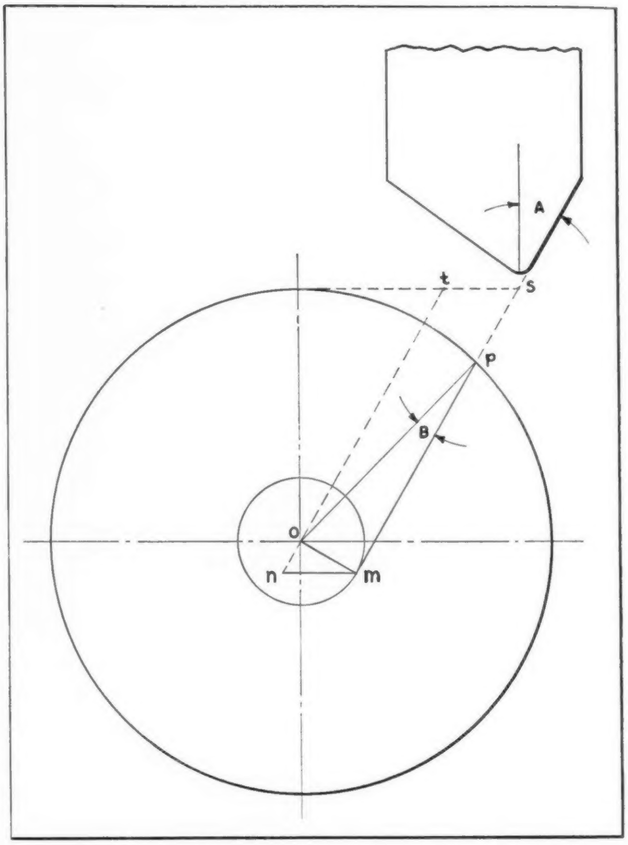


Fig. 2. Position of Fluting Cutter for Producing Positive Rake Angle B is Distance st behind Radial Position Shown by Dotted Line ot

Referring to both Figs. 1 and 2, draw a circle with point *o* as a center and tangent to the non-radial side *ms* of angle *B*. Side *ms* is also an extension of the line forming the small angle side of the fluting cutter. It is, therefore, parallel to *ot*, which is an extension of the same line when the cutter is in a radial position. Since *om* is a radius drawn from the point of tangency of *ms*, it is at right angles to *ms* and, therefore, is also at right angles to *ot*.

In right-angle triangle *omp*,

$$om = op \sin B \qquad (1)$$

In right-angle triangle *nom*,

$$\text{Angle } nmo = \text{angle } A \qquad (2)$$

since their respective sides are at right angles to each other.

Therefore,

$$nm = om \sec nmo = om \sec A \qquad (3)$$

But

$$nm = st \qquad (4)$$

Substituting the equivalent of om from Equation (1) and the equivalent of nm from Equation (4) in Equation (3), we have:

$$st = op \sin B \sec A \qquad (5)$$

This equation may be expressed in the form of a rule as follows: The amount of horizontal offset equals the radius of the work times the sine of the required rake angle times the secant of the small angle of the fluting cutter.

The two following examples show the procedure in computing the offset for producing negative and positive rake angles, respectively.

Example 1—Find amount of offset required to produce a negative rake angle of 8 degrees when the radius of the blank is 3 inches and the small angle of the cutter is 30 degrees. The known values are $B = 8$ degrees; $op = 3$; and $A = 30$ degrees.

Then

$st = 3 \times \sin 8$ degrees sec 30 degrees

$st = 3 \times 0.13917 \times 1.1547$

$st = 0.482$ inch ahead of the radial position

Example 2—Find amount of offset required to produce a positive rake angle of 8 degrees when the radius of the blank is 3 inches and the small angle of the cutter is 30 degrees. Here the given values are: $B = 8$ degrees; $op = 3$; and $A = 30$ degrees.

Then

$st = 3 \times \sin 8$ degrees sec 30 degrees

$st = 3 \times 0.13917 \times 1.1547$

$st = 0.482$ inch behind the radial position

* * *

Increase of Apprentices in the Mechanical Trades

The number of registered apprentices in the machinist, tool- and die-maker, automobile mechanic, and airplane mechanic trades has increased 50 per cent over a twelve months' period, according to William F. Patterson, Director, Bureau of Apprenticeship, U. S. Department of Labor. The following figures are for apprentices on file with his agency, but the totals do not represent complete coverage of the country: Machinists, 16,800; tool- and die-makers, 13,800; automobile mechanics, 22,300; and airplane mechanics, 1600.

* * *

The production of 100,000,000 motor vehicles since the beginning of the automotive industry, fifty-odd years ago, amounts to an average of 2,000,000 vehicles per year.

A Mobile Fastening Exhibit Displayed in an Automobile Trailer Unit is being Used by Shakeproof Inc., Chicago, Ill., to Extend Fastener Engineering Service to Industry. This Illustration Shows the Trailer Interior. Both the Walls are Lined with Exhibits and Special Testing Equipment for Illustrating and Demonstrating Various Types of Fastenings

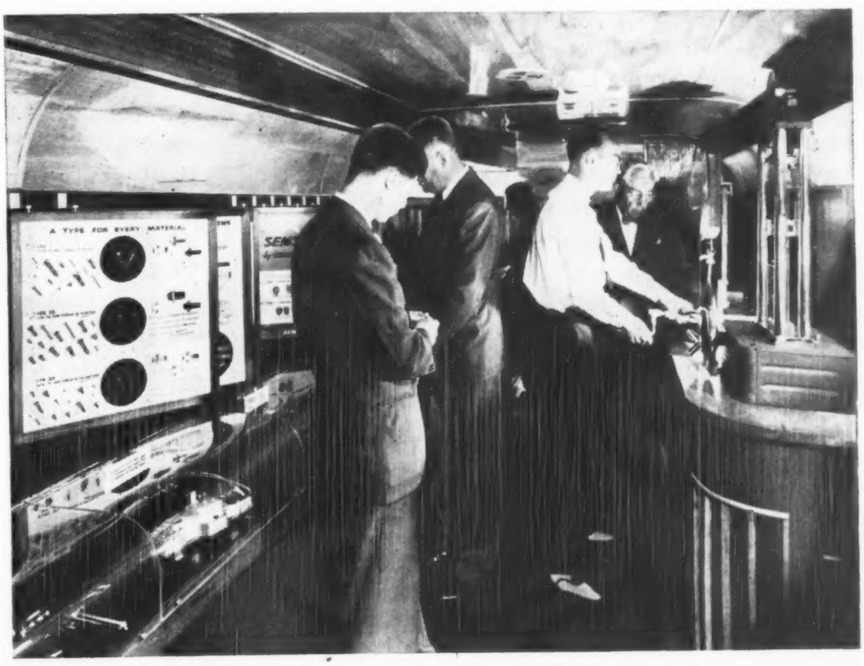


Fig. 1. Horizontal Welding is Considerably Facilitated by High Deposition Rate of the Gas-shielded Metal Arc-welding Process

Gas-Shielded Metal Continuous Filler

This Process, which is Particularly Suitable for Welding Aluminum and its Alloys, Permits Welding of All Standard Joint Designs in Flat, Horizontal, Vertical, and Overhead Positions

A METHOD of shielded metal arc-welding in which a consumable filler wire is continually deposited in a controlled gaseous atmosphere has recently been developed by the Air Reduction Sales Co. to overcome certain limitations of existing welding processes. The method is known as the "Aircomatic" process. Briefly, it consists of feeding a bare or processed filler metal in wire form through a suitable holder. This filler metal carries welding current, and an arc is maintained between the end of the wire and the work. Power may be supplied from a standard welding generator. The arc is maintained within a controlled envelope of shielding gas. The equipment developed for the process includes both a manual gun and an automatic head.

With the manual unit, welding can be performed in all positions—that is, flat, horizontal, vertical, and overhead, as illustrated in Figs. 1, 2, and 3. All of the standard joint designs can be welded in these positions. Single- or multiple-layer welds can be deposited, using either beading or weaving techniques. Vertical welds can be made with either upward or downward travel. In short, the new process has all the facility associated with metal arc-welding of steel plus the advantages of a high deposition rate resulting from the continuous filler metal feed and the absence of slag. As far as is now known, this is the first time that a continuous wire feed has been employed for welding in the vertical and overhead positions. Research indicates that this process will be capable of welding many metals.

The Aircomatic process is particularly adapted to the welding of aluminum and its alloys. It has been found that direct current, reversed polarity, provides the necessary arc conditions. Standard direct-current welding generators, including constant-potential, multiple-operator units, are suitable for this work. Argon has been found to be a satisfactory shielding gas for aluminum welding. The welding grade argon now supplied for Heliarc welding is suitable.

One of the principal features of this process is the use of very high current densities. Current densities twelve times those used in ordinary metal arc-welding have been successfully employed. With such high current densities it becomes necessary to provide high rates of filler-metal feed in order to make satisfactory welds. Filler-wire speeds for the manual welding gun range from 100 to 300 inches per minute.

The arc obtained with this process may be described as non-sensitive, since changes in arc length result in smaller changes in voltage than are encountered in normal metal arc-welding. Observation of the arc discloses that it consists of a relatively narrow incandescent core surrounded by an umbrella-shaped envelope. The outer envelope provides a cleaning action, thus eliminating the need for welding fluxes.

For the manual welding of aluminum as provided in this process, only three sizes of filler metal are needed, namely, 3/64, 1/16, and 3/32 inch. With these filler-metal sizes, the over-all current range is 70 to 450 amperes, which permits the welding of metal thicknesses from 1/8 inch up to 2 inches and more.

The selection of filler-metal composition is governed by the metal to be welded. For the welding of 2S and 3S material, 2S wire is recommended; for 52S and 61S material, either the 43S or 716 analysis may be used. This process gives promise of reducing some of the limita-

Arc-Welding with Metal Feed*

By JESSE S. SOHN
Air Reduction Laboratories
Murray Hill, N. J., and
A. N. KUGLER
Technical Sales Division
Air Reduction Sales Co.
New York, N. Y.

Fig. 2. Gas-shielded Metal Arc-welding Permits Either Upward or Downward Travel in Making Vertical Welds with a Manual Unit

tions now encountered in the welding of heat-treatable aluminum alloys.

A manual unit is commercially available for the gas-shielded metal arc-welding of aluminum and its alloys. The component parts of the manual unit are illustrated schematically in Fig. 4, along with the necessary direct-current power source and cylinder of argon. Starting with the welding gun (see detailed view, Fig. 5), it will be observed that it has (1) an attached welding cable from the generator; (2) a gas (argon) hose, inside of which is the metallic tube for conveying the filler-metal wire; and (3) a small three-conductor control cable. The gas hose and wire conductor are connected at the other end to the feed motor box, and the control cable also connects with this box, as seen in Fig. 4. The feed motor box contains the governor-controlled motor, speed reducer, feed-rolls, and a solenoid valve. The control box, which is connected by the three-conductor control cable to both the gun and the feed motor box, contains the relays which control operation of the wire feed. The remaining piece of equipment is the wire reel for the filler metal.

The gun, as seen in Fig. 5, is equipped with a trigger which readies the unit for welding, and a "jog button" for feeding wire when not welding. To start welding, the trigger is depressed (it can be locked in the "on" position by means of a button) and this starts the argon flow which purges the lines. Next the electrode, which should project 1/2 to 3/4 inch from the gas nozzle, is scratched on the work, and when arc voltage is established, the controls operate to energize the feed motor and deliver filler metal. A current contactor is placed in the welding circuit, and is connected through the control circuit for operation by the trigger on the gun. When using a contactor, the trigger is used for starting and stopping the welding. One of the advantages of using a contactor is that the gun is "dead" when the trigger is in the released position.

Fig. 4 shows the general paths of the argon shielding gas and welding current. It will be noted that the gun is essentially simple, since most of the control and driving mechanisms have been placed in the other units. The argon passes down the "barrel" of the gun and issues from the gas nozzle surrounding the wire electrode. As both the gas nozzle and the wire guide tube are close to the welding arc, they will gradually deteriorate. In consequence, these parts are constructed simply, to permit of rapid and economical replacement.

The wire and the argon, as previously mentioned, are carried in one conductor. The governor-controlled driving motor contained in the feed motor box provides the variable speeds necessary for the filler-metal feed. This motor, operating on a 110-volt circuit, drives a pair of feed-rolls through a speed reducer. The rolls draw the filler metal wire from the reel and propel it to the gun. The solenoid valve turns on and shuts off the flow of argon, as controlled by the trigger on the gun. From the solenoid valve, the gas is fed to the combination gas-wire feed conductor by means of a plastic hose and a tee connection.

The control box houses the transformer which provides the low voltage necessary for the control circuit, as well as the relays which control

*Abstract of a paper presented before the recent annual meeting of the American Welding Society.

the operation of the wire-feed motor. The control cable from this box leads to both the gun and the feed motor box. An additional conductor, leading from the box to the work, provides the ground for the control circuit.

The speed of wire feed, controlled by the manually set, mechanically governed motor, remains constant, after once being established, regardless of what takes place at the welding arc. Selection of the welding current and wire-feed speed for a given size of filler wire results in a definite arc length, and hence arc voltage. Thus, changes in arc length can be accomplished by either of the following methods: (1) By varying the wire-feed speed through the governor on the motor; and (2) by changing the current. In the first instance, assuming a given welding generator setting, increases in wire-feed speed result in a decrease in arc voltage. Obviously, such a decrease in arc voltage is accompanied by an increase in welding current, the value depending upon the characteristics of the direct-current generator used. It follows that decreases in wire-feed speed have the opposite effect. In the second case, assuming constant wire-feed speed, changes in welding generator setting result in an increase in arc voltage when the setting is raised and a decrease when it is lowered. This self-regulation of the arc resulting from the combination of a drooping generator characteristic and a high burn-off rate makes this welding process essentially automatic.

In welding with the gas-shielded metal arc-welding process, the arc is initiated by "scratching" the electrode rather than tapping. When the arc is established, the gun is moved so as to bring the shield about 1/2 inch from the work. For welding, the gun is held so that it points ahead in the direction of welding, which is the same as forehand welding with the oxy-acetylene process. To terminate a weld, when no welding current contactor is used, the arc is broken with a quick snap. If a contactor is used in the circuit, releasing the trigger on the gun cuts off the welding power, wire feed, and argon flow. The length of the arc should be 1/16 to 3/16 inch. It should be noted that holding the gas nozzle much over 1/2 inch from the work will reduce the effectiveness of the gas shield. Incomplete shielding results in the formation of a crust on the surface of the weld.

For welding aluminum by this process, it has been found that the flow of argon is not critical as long as it is maintained within reasonable limits. When welding with the manual gun, an argon flow of between 20 and 50 cubic feet per hour is used. In general, the lower flow rates are for low current values, and the higher rates for the higher currents. Also, the minimum rates of flow may only be used with short distances between the gas nozzle and work. Greater distances or drafty conditions will require more gas flow. Once the flow has been determined for a given welding condition, it can be varied by as much as plus or minus 10 per cent without adversely affecting the operation. It has been demonstrated experimentally that up to 20 per cent more argon will be needed when making fillet welds on tee joints in order to provide shielding gas at the root of the joint.

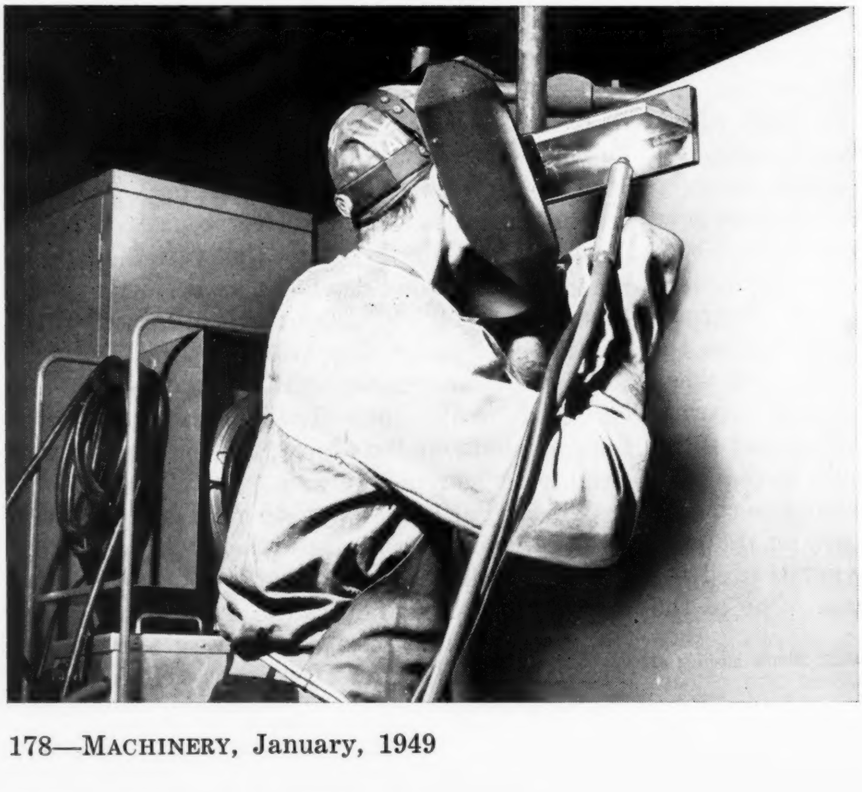


Fig. 3. Continuous Wire Feed of Filler Metal is a Feature of Gas-shielded Metal Arc-welding. Here a Manual Unit is seen being Used for Overhead Welding

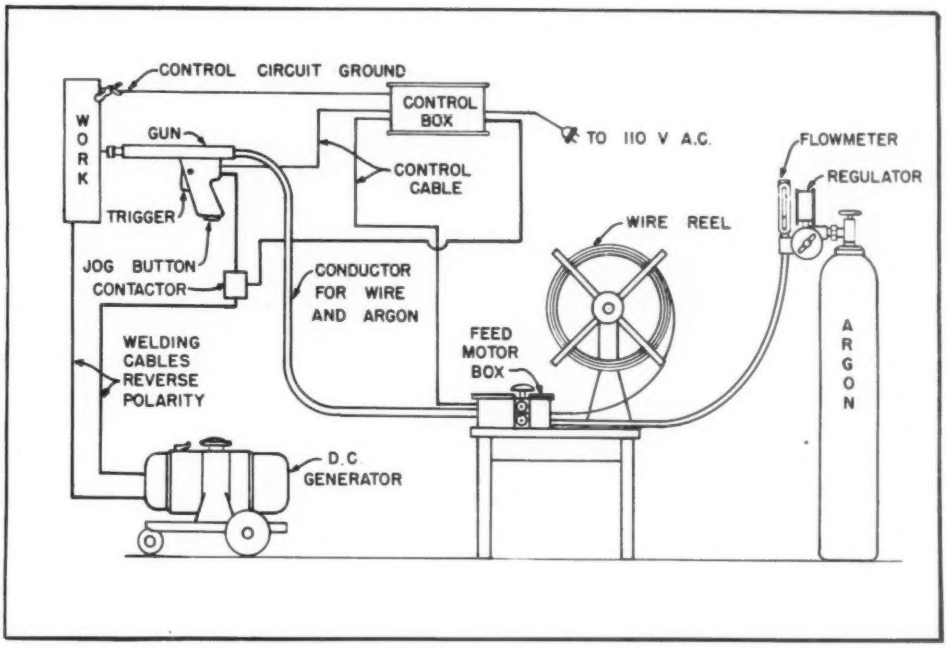


Fig. 4. Schematic Diagram of Component Parts of the Manual Unit Used for Gas-shielded Metal Arc-welding

The mechanical properties of aluminum welds are equal to the properties obtained in castings of the same analysis as the filler metal. The quality of welds produced in aluminum by this process is, as indicated previously, dependent upon many variables. It may be stated generally that the welds will be superior to welds made with aluminum metal arc electrodes. Further, under proper conditions, the quality will approach that obtainable with the inert-gas tungsten arc method. The welds are of excellent surface appearance.

Porosity may be encountered in aluminum welds; this is of two distinctive types—internal porosity readily visible with radiographic techniques, and micro-porosity not detectable under normal radiographic procedures. The former is subject to control, while the latter appears to be associated with most rapidly cooled cast-aluminum alloys.

Tensile strengths of 27,000 pounds per square inch, with 8 to 10 per cent elongation, have been obtained on 43S all-weld metal specimens welded in the vertical position. It is recommended that both aluminum-base metal and filler metal be cleaned to insure high quality welds.

Attention is directed to the fact that welding of heavy aluminum sections can be accomplished with little or no preheat. This practice is in sharp contrast to other processes wherein the filler metal is added by indirect methods.

The Aircomatic welding process, in effect, combines the desirable features of both metal arc-welding and inert-gas shielded-arc welding.

* * *

The typical 1948 car weighs 150 pounds more than the 1941 model; 500 pounds more than the 1937 model; and twice as much as the 1918 model.

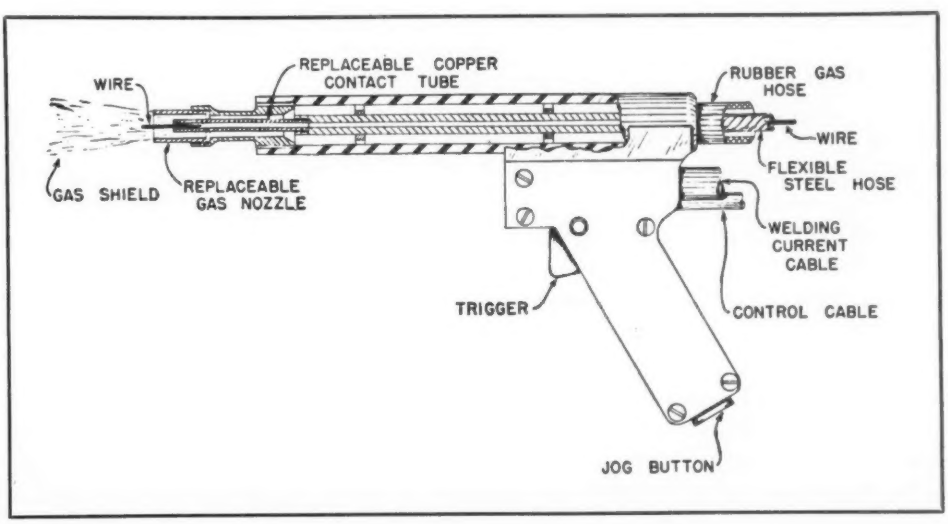


Fig. 5. Diagram of the Manual Welding Gun Used in Gas-shielded Metal Arc-welding

Selection of Materials for Plastic Molds

By L. J. MORRISON
Detroit Mold Engineering Co.
Detroit, Mich.

Abstract of an Address Recently Delivered before the Annual Meeting of the New England Section of the Society of the Plastics Industry

ONE of the questions most frequently asked of our company is the proper steel to use for the cavities of plastic molds. From the standpoint of manufacture, the steel used for the mold should be free-machining for machined cavities, and should bob easily under low tonnage for hobbed cavities. Both types of steel should be capable of being polished to a high finish, and undergo minimum distortion when hardened. The steel must be free from impurities and defects, such as sulphides, segregation, or porosity. From the molder's standpoint, the steel should have a high surface hardness after hardening, and sufficient strength in the core. High tensile strength may be paramount in some sections.

Machine steel (S A E 1020) was one of the earliest cavity materials. However, this has largely been supplanted by alloy steels because of its many faults. Relatively speaking, it is not strong, and must be carburized in order to be hardened appreciably. The case thus formed is satisfactory, but the core is not affected by the heat-treatment and remains soft. It will take a polish sufficiently good for many jobs, but not sc good as the alloy steels. Distortion in heat-treating is maximum in this steel.

Characteristics of Alloy Carburizing Steels

The alloy carburizing steels represent from 60 to 70 per cent of the tonnage used in plastic molds. Many different analyses fall in this category; for example, S A E 4615, S A E 3120, S A E 3312, and S A E 4130. These steels have the common fault—characteristic of carburizing steels—of dimensional change in hardening, but careful heat-treating can minimize this.

The alloys in S A E 4615 steel serve not only to toughen the steel, but also to improve the carburizing properties, as they increase the rate of carbon pick-up at the surface. A core hardness of 280 Brinell can be expected after heat-treatment. In the annealed condition, machining and finishing properties are excellent. The electric furnace type is preferred to open-hearth steel.

Improved hardenability and polishing properties are features of S A E 3120 steel. Core strength will be as high as 130,000 pounds per square inch. This steel is not so easy to machine as S A E 4615, but it is not classified as a really difficult machining steel.

S A E 3312 steel can be hardened in air after carburizing, and therefore distortion due to heat-treatment can be minimized. Core properties are excellent—160,000 pounds per square inch tensile strength and 360 Brinell hardness. Machining and finishing are considerably more difficult than with the steels previously mentioned. All air-hardening steels have the further disadvantage of requiring careful annealing after welding in case of repair. Even the heat generated by a dull cutter will sometimes cause local hardening that will be very troublesome.

Steels of the S A E 4130 type are very popular as carburizing mold steels. While the tensile strength and hardness are high, the toughness and dimensional stability are not so good as in the S A E 3312 type.

Oil- and Air-Hardening Steels Suitable for Mold Cavities

Water-hardening steels are seldom used for cavities. The drastic quench necessary in heat-treatment makes the steel too susceptible to cracking and distortion. However, a great variety of oil-hardening steels are used.

Steels similar to S A E 1090, but with a higher manganese content, have been used on small and medium-sized cavities with varying success. However, alloy types have been used more widely because of their improved toughness and better finish. S A E 6150 is very popular, being a tough steel having a fine grain. With an oil quench, the steel hardens to about 50 Rockwell C. Machinability and finishing properties are good. The stability in heat-treatment of this steel is above average, and it is

known as a safe steel for use in mold cavities of large size.

A general-purpose oil-hardening steel made by many companies is of the following composition: Carbon, 0.90 per cent; manganese, 1.25 per cent; chromium, 0.50 per cent; and tungsten, 0.50 per cent. Such steels are somewhat more difficult to machine than S A E 6150, but still have good machinability. They harden to 60 Rockwell C with an oil quench. Heat-treatment of large uneven sections, however, is risky.

The physical properties of some air-hardening steels are probably the best of all for mold cavities. They have maximum core strength and toughness, as well as a surface hardness up to 58 Rockwell C. The polish attainable is second only to that obtained on stainless steel. Distortion in heat-treatment is at a minimum, for there is no size change due to absorption of carbon, as in carburizing, or change due to drastic quench. These steels are known as "hot-work" die steels, and are characterized by a medium carbon content of about 0.35 to 0.45 per cent; 4.0 to 5.0 per cent chromium; and smaller percentages of molybdenum, silicon, vanadium, and tungsten. However, such hot-work steels are among the most difficult to machine and finish.

For cavities of injection molds, it is questionable if steel of this quality is necessary, but for cavities and punches for compression molds, the best is often none too good. Long cores and cavity sections subject to high transverse strains should be made of hot-work steel.

High-carbon, high-chromium, air-hardening steels are seldom used for cavities, but are suitable for hobs, where their high compression strength is of advantage. They do not have the toughness and resistance to transverse strain characteristic of the hot-work steels.

Stainless Steel Used where High Polish is Necessary

When it is necessary to have the best polish possible, stainless steel is preferred. For this work, steel having an analysis of 0.30 per cent carbon and 13.0 per cent chromium is widely used. It is considered quite difficult to machine and polish. Free-machining grades are made by the addition of sulphur, but a high sulphur content makes a "dirty" steel, which will not polish to the degree usually required of stainless steel.

Hobbed Cavities Present Special Problems

Cavities made by the hobbing process present even more problems. In order to make steel as plastic as possible for best hobbing conditions, the carbon content is lowered and alloying elements are removed. The resulting cavity steel can be hardened only by carburizing. As with S A E 1020 steel, the surface conditions are good, but the core remains dead soft—a highly undesirable state. Steels other than the plain low-carbon variety can be, and are, hobbed, but only at the expense of additional hobbing pressures, which makes for more difficult hobbing. S A E 3110 is typical of the alloy hobbing steels. Core strength is about two to three times as good as plain carbon hobbing steel, and the machinability is about the same.

For master hobs, two types of steel are very popular. Tungsten chisel steel is probably the more widely used, and has an approximate analysis as follows: Carbon, 0.50 per cent; manganese, 0.20 per cent; silicon, 0.75 per cent; chromium, 1.20 per cent; tungsten, 2.50 per cent; and vanadium, 0.25 per cent. Pack-hardening in charcoal, followed by an oil quench, gives a very hard skin (from 61 to 63 Rockwell C) and an extremely tough core. Among the main causes of hob breakage are transverse strains due to irregularities of shape. This steel is especially resistant to such transverse strains.

High-carbon, high-chromium steels are also used for hobs because of their extremely high compressive strength and ability to be held to dimension during heat-treatment. Any transverse strains, however, are likely to break hobs made from this steel; but the steel will resist compressive forces that would crush chisel steel.

Recent Developments in Mold Steels

Recent developments in mold steels have been principally along the lines of hobbing steels, efforts being made to improve machinability, raise core strength, and increase dimensional stability during heat-treating. One company has been trying a graphitic steel that will harden in oil. A second is experimenting with the production of a 0.90 per cent carbon steel that will have a deep case and a hard core after carburizing. Tests have proved that both steels can be hobbed, but the tonnage needed is somewhat in excess of that required by S A E 3110 steel. Additional research may perfect both.

The Westinghouse Corporation, Carpenter Steel Co., Crucible Steel Co., and Bethlehem Steel Co. have developed air-hardening hobbing steels. The analyses of all four steels are quite similar, approximating 0.10 per cent carbon; 0.37 per cent manganese; 5.0 per cent chromium; 1.00 per cent molybdenum; and 0.35 per cent vanadium. The steel is more easily machined than conventional hobbing steels, but

does not work-harden as rapidly. It is hardened by carburizing and quenching in air, with very little deformation. The surface hardness resulting from such treatment is 57 Rockwell C, and the core hardness 25 Rockwell C.

It is sometimes economical to make a large cavity of cast iron in order to try out a method of molding. Electro-formed cavities—those made by plating iron on a rubber master—are occasionally useful for injection molding of intricate work. However, the problem of backing up the plated cavities has not been satisfactorily solved. Cavities made by spraying molten alloy steel on a revolving water-cooled master have been tried, but the process is still in the experimental stage.

Beryllium copper as a cavity material has great potentialities. It will reproduce the finish of the master it is cast upon, and can be hardened to 40 Rockwell C. It is quite tough and does not tend to chip or crack. New alloys are being developed that will harden to 50 Rockwell C. However, there is much work yet to be done on casting technique and material handling. Beryllium copper finds its main use in cavities for injection molds, and is seldom used for compression molds.

If production is such that the mold must be run to destruction, the best materials should be used, regardless of cost or ease of machining. Molded parts whose design changes periodically can be made in cavities of less durable material. Often on long-run jobs of intricate shape, it is cheaper to use hobbed cavities or beryllium copper cavities until they are no longer serviceable. Replacement of these cavities is usually inexpensive. When extreme accuracy is of paramount importance, the air-hardening or hot-work type steels are best, because of the fact that there is little dimensional change in heat-treatment with these steels. For extremely large sections, carburizing type steels are favored because there is less danger of cracking in heat-treating.

Portable Jig Boring Tool Facilitates Work on Large Assemblies

SAVINGS of thousands of dollars have been made by the use of a portable jig boring tool developed by the Consolidated Vultee Aircraft Corporation, San Diego, Calif., to expedite precision work on forgings or castings that are assembled on major airplane components. This tool is especially adapted for machining parts that are too large to be handled on stationary boring machines, as well as fittings already installed.

As shown in Fig. 1, the tool is of simple construction, consisting essentially of a boring-bar *A*, which is rotated in a stationary block *B* by means of a universal-joint drive *C*, located at the left-hand end of the tool. The tapered shank of the drive can be placed in the spindle of any

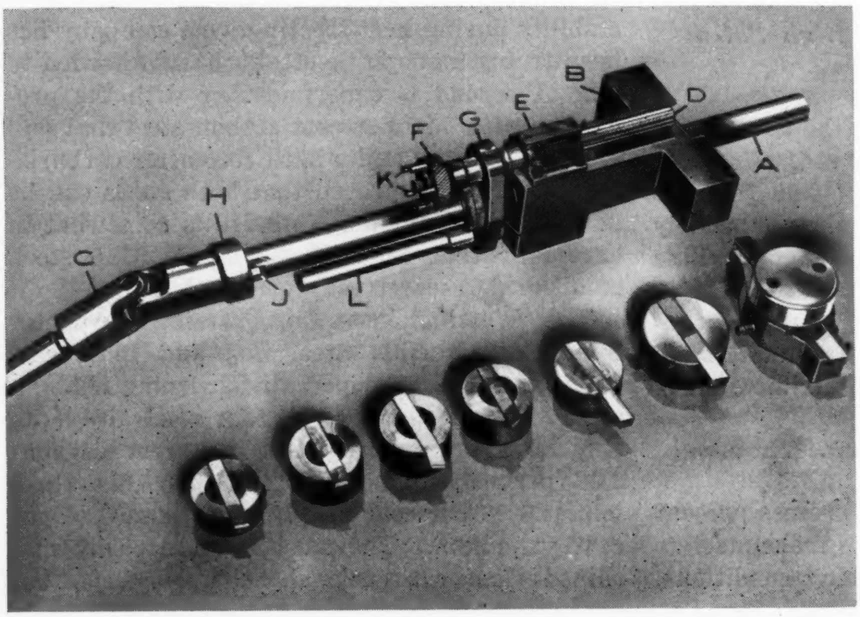


Fig. 1. Portable Jig Boring Tool Consisting Essentially of Boring-bar A, which is Rotated in Stationary Block B by Universal-joint Drive C, and Fed by Lead-screw D

Fig. 2. Forged Landing-gear Fitting being Jig-bored while Assembled to an Airplane Structure by Means of the Portable Tool Shown in Fig. 1. The Tool is Arranged for Automatic Feed

standard portable electric or pneumatic tool to obtain a source of power. Boring, chamfering, spot-facing, or other cutting tools, mounted in adapter rings as seen in the foreground, are clamped to the right-hand end of the boring-bar.

The boring-bar is fed through the stationary block by means of a finely threaded lead-screw *D*. The lead-screw operates in a split nut *E*, which is bolted to the stationary block, and the lead-screw is rigidly connected to the boring-bar by means of collar *G*. Manual feed of the tool is accomplished by rotating calibrated disk *F*. The tool can be easily and quickly converted to power feed by sliding ring *H* along the boring-bar to the right until projection *J* is beside pins *K* extending from the face of disk *F*. Ring *H* is then secured to the boring-bar by a set-screw, and as the boring-bar rotates, projection *J* will progressively contact the pins on the disk, thus rotating the lead-screw and feeding the tool. Bar *L*, which is rigidly attached to block *B*, serves to guide the boring-bar and prevent bending of the lead-screw.

A forged landing gear fitting assembled to the structure of a Convair airplane is shown being jig-bored in Fig. 2. Here the sliding ring has been advanced on the boring-bar to automatically feed the tool. A Chicago Pneumatic portable tool is employed as a source of rotary power. The universal drive of the jig boring tool permits the source of power to be offset in crowded spaces. An adapter plate is shown mounted on the front of the stationary block. The bore of the adapter plate fits around the periphery of the hub on the part, thus locating the tool concentric with the hole being bored. Holes can be bored to $\pm$ 0.00025 inch of the desired size.

Before the development of this portable tool, it was necessary to locate and fasten certain work-pieces and jigs on the table of large jig boring machines. In many instances, this involved the cost of disassembling the part to be machined. Setting up of the machine required considerable time, and production work regularly scheduled on the machine was delayed. Some jobs too large to set up on standard machines had to be shipped to firms with larger tools.

The tool can be manufactured for approximately $300, and can be used for many different kinds of jobs. Several auxiliary attachments have been designed for use with the tool, including an adapter bar for drilling, a boring-bar containing an adjustable tool, and a pick-up bar for accurate location from toolmakers buttons.

To rework the tie-in bolt-hole of an airplane engine mount previously required the construction of a special jig and represented nearly a week's work. Now the job can be accomplished in approximately three hours. Another job requiring the boring of five holes in a welding fixture too large for a jig boring machine, required about 150 hours of set-up and machining time on a large boring mill. With the portable jig boring tool, the same job was completed in less than six hours.

* * *

Englishman William Gilbert was called the founder of the science of electricity in 1603 because of his discoveries of electric phenomena in 1560. It wasn't until a century later that the first electric spark was produced by a man, Dr. J. Wall, also of England.—*The Kablegram*

Analyzing the Effects of Stretch-

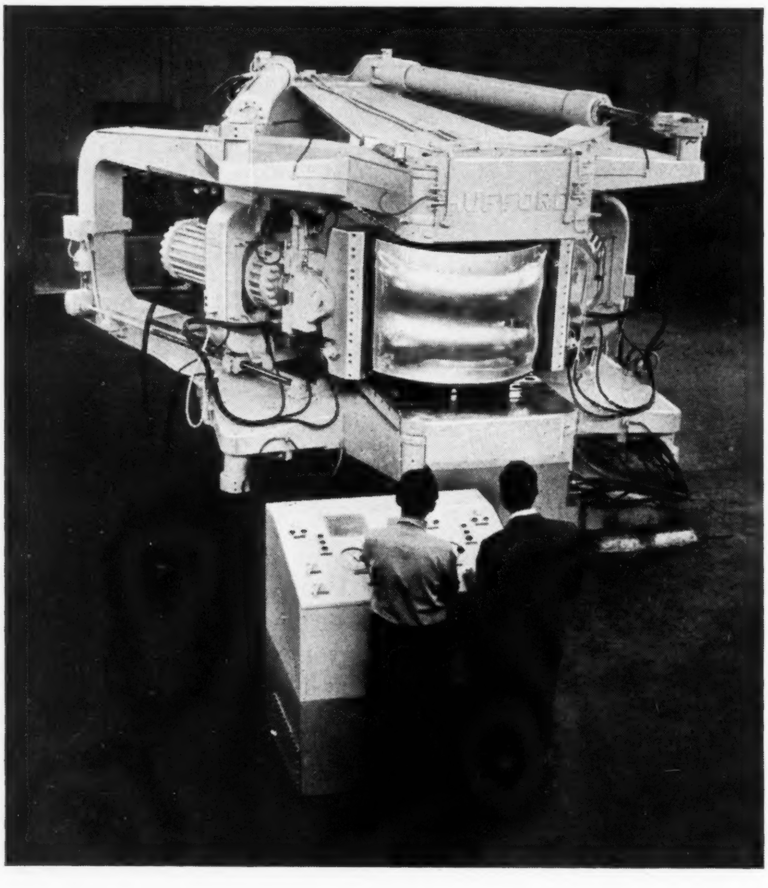


Fig. 1. Sheet-metal Stretch-wrap Forming Machine Developed by the Hufford Machine Works, Inc.

System Developed for Charting the Amount and Location of Elongation that Occurs in Stretch-Wrap Forming of Sheet Aluminum. This Data Can be Used in Determining the Exact Pressure Required for Subsequent Work

By W. T. KLUGE, Metallurgist
Production Development Laboratory
North American Aviation, Inc.
Los Angeles, Calif.

SHEET-METAL aircraft parts, such as skin contours, fillets, scoops, and wing tips, are now economically shaped by means of stretch-wrap forming. On the Hufford stretch-forming machine, shown in Fig. 1, the process consists of pre-stretching to its yield point, or slightly beyond, a sheet of material that is held at the ends in suitable jaws, after which the sheet is wrapped around a die of the required contour and given a final stretch to set the sheet to the die contour.

High-strength aluminum alloys 1/4 inch thick and heavier, half-hard stainless steels, and high-temperature-resistant alloys are among the aircraft materials suc-

Fig. 2. Two Aircraft Engine Cowling Rings are Formed Simultaneously in a Stretch-wrap Forming Machine

Wrap Forming of Sheet-Metal Parts

cessfully formed in this manner. Typical parts handled by this process are illustrated in Figs. 2 and 3. In Fig. 2, two engine cowling rings are shown being stretch-wrap formed, and in Fig. 3, a wing tip blank is seen at the completion of the stretch-forming operation, wrapped around the die and backing plate.

Among the advantages of the machine illustrated, which was developed by the Hufford Machine Works, Inc., Redondo Beach, Calif., are the open die bed and the freedom of jaw movement. The jaws can be locked or allowed free movement for both rotating and tilting. They can easily be set so that the surface of the sheet being formed is tangent to the die at any desired point, maintaining that point of tangency throughout the stretching operation. The jaws exert a straight pull on the sheet, and thus allow control of the amount and location of the forming.

A system for analyzing the effects of the forming operation has been developed by North American Aviation, Inc., in order to take advantage of the control over forming available on this type of stretch-forming machine. In this method, the amount of elongation of the material in any location or direction can be determined by applying a grid to the surface of the sheet being formed by means of a photographic process. The surface to which the grid is to be applied is given a mat finish by lightly etching or abrading with steel wool. The cleaned surface is then sprayed with a sensitizing solution. The sprayed coat should provide a dull gray appearance, and care must be taken, in applying the solution, to avoid too heavy a coat. A heavy coat appears shiny and tends to wash off completely after exposure.

The negative of the grid to be applied is placed in contact with the sensitized surface of the part to be formed before an intense light, after which the coating is washed freely with water to remove the unexposed portion. After drying, grids prepared in this manner will withstand considerable abrasion, and have been found to be still legible after being subjected to aluminum-solution heat-treatment and quenching.

Stretch-wrap forming elongates the sheet in the direction of stretching, with a resulting reduction in thickness and width. After forming, the grids on the blanks show the resulting alongation, the magnitude of which is determined with the aid of a magnifying glass and a scale graduated in hundredths. Several readings are made at different locations, and the results noted on the sheets.

An example of the grid and notations may be seen on the engine cowling ring illustrated in Fig. 4 and on the wing tip shown in Fig. 5. The engine cowling ring, in the blank stage, was provided with an orthagonal grid having ten lines to the inch, and was exposed to a high-pressure mercury lamp for six minutes, at a distance of 24 inches. The original grid negatives have an accuracy of 1 per cent between individual lines.

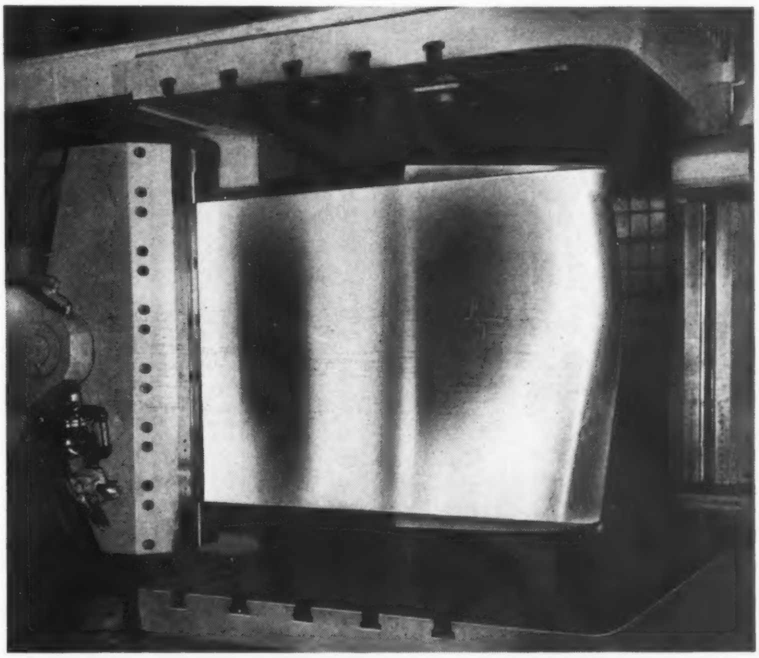


Fig. 3. An Aircraft Wing Tip Blank Wrapped around a Die and Backing Plate. Both Ends of the Sheet are Gripped by One Jaw of the Stretch-wrap Forming Machine

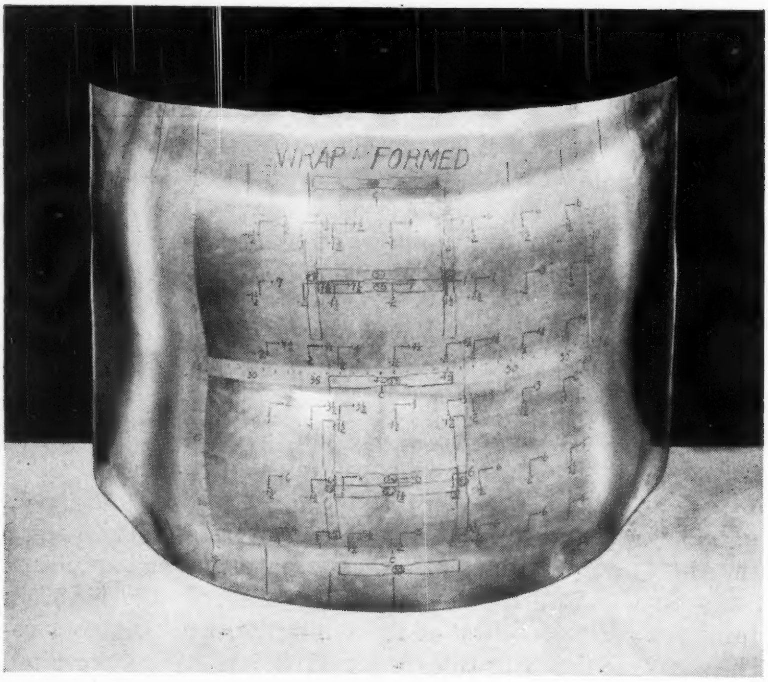


Fig. 4. Aircraft Engine Cowling Ring with Amount and Location of Elongation Resulting from Stretch-forming Marked on Grid

Measurements were made over ten lines to the nearest 0.005 inch or 1/2 per cent elongation.

Forming of the engine cowling ring required only moderate stretching of the material. The resulting amount and location of elongation are indicated graphically on the chart shown in Fig. 6, which is typical of the charts made to record the effects of stretch-wrap forming. It can be seen that the locational dimensions noted on the grid are given on the upper ordinate and the right-hand abscissa of the chart. The small white circles representing longitudinal elongation and the black circles indicating transverse elongation are plotted on the chart according to these locations on the grid and the percentage of elongation. Thus the amount and location of stretching are recorded.

As an example, reference to the white circle in the upper left-hand corner shows it to be located at 32 inches in the direction of stretching and at 9 inches across the direction of stretching. It is 5 1/2 per cent up from zero in the percentage of elongation range. The black circle immediately below it is —1 1/2 per cent down from zero. This agrees with the measurement on the grid, which indicates elongation at that point to be 5 1/2 per cent in the longitudinal direction and —1 1/2 per cent in the transverse direction. Further reference to the chart shows that the reduction in width of the grid lines in the transverse direction is fairly uniform across the sheet, regardless of the local elongation in the longitudinal direction.

To determine the physical properties of the material after forming, standard tensile coupons are laid out on the grid in both directions in areas of various elongation. After forming, the parts are cut transversely into strips 5 inches wide, avoiding cutting the tensile coupons. In this way, the whole part may be surveyed for

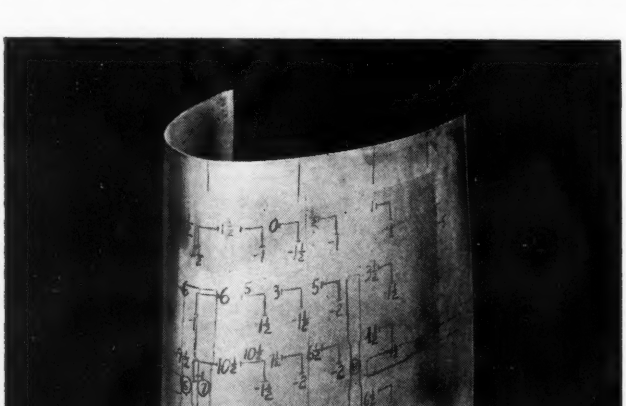


Fig. 5. Aircraft Wing Tip Showing Notation of Data on Elongation Resulting from Stretch-forming. Tensile Coupons on Wing-tip Blank are Used to Determine Physical Properties of Material after Forming

reduction in thickness. The range of thicknesses occurring as the result of varying reductions are represented by the tensile coupons. These are machined and tested in tension, using a stress-strain recorder to determine the yield strength of the material.

To facilitate the operation of stretch-forming machines, charts are prepared which give the yield point and ultimate load directly for all thicknesses and widths of sheet materials commonly used in production. The range of pressure or load, from the yield point to the ultimate, is, roughly, the forming range of the part. Therefore, with the aid of a chart provided for each machine, an operator can predetermine the stretching pressure that will be at the yield point for the full width of the blank. He will also know the pressure at which fracture is likely to occur.

Further examination of the stretch-forming process by the grid method of analysis will provide additional information, which will aid in taking full advantage of any flexibility and control available during forming. With continued research and development, the potentialities of stretch-wrap forming can be exploited to the advantage of production and design.

The Wise Owl Club Promotes Eye Protection

An original idea for promoting the use of goggles to protect the eyes has been announced by the National Society for the Prevention of Blindness, 1790 Broadway, New York 19, N. Y. It is the organization of what is known as the Wise Owl Club, consisting of men and women who have been saved from blindness in industrial accidents by wearing safety goggles.

The originator of the idea was Joseph Folks, a grinder in the cleaning room of the St. Louis Foundry of the American Car and Foundry Co. A flying chip of metal cracked Joe's safety goggles, but his eyes were unhurt. He conceived the idea that if those having similar experiences would band together into a club to publicize the value of wearing safety goggles, it would be an incentive to others to do the same. The safety director of the company, F. H. Humphreys, organized the clubs in all of the company's plants. Mr. Humphreys presented the idea for nationwide sponsorship to the National Society for the Prevention of Blindness. Those interested in organizing such clubs can obtain further information from the Society.

* * *

Heavy Sheets Galvanized by Continuous Process

Heavy galvanized sheets are now being produced at the rate of 300 tons a day by a continuous-coating galvanizing line recently installed at the Irvin Works of the Carnegie-Illinois Steel Corporation. A similar line for the production of light gage material will also be placed in operation within a few months. The new continuous process is said to turn out a product of better quality than was formerly produced by the hand sheet galvanizing method, and at the same time, additional processes, such as box annealing, sheet pickling, and hand feeding, are automatically eliminated. Another advantage of the process is that it produces an adherent coating that will not break in forming or bending of the sheets.

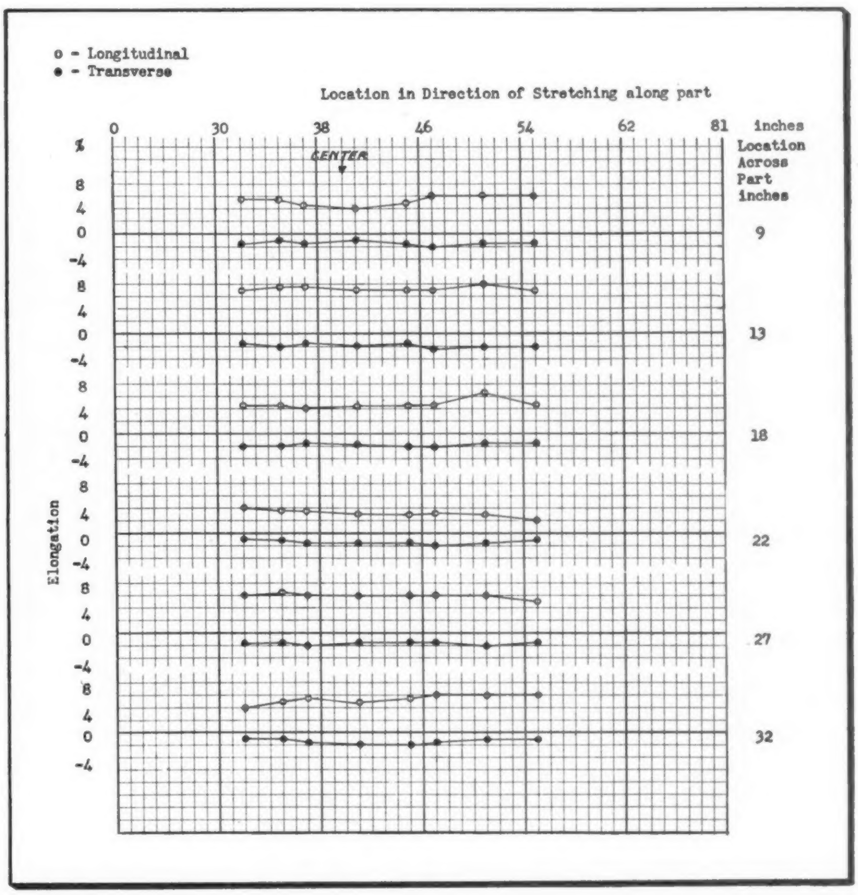


Fig. 6. Chart Showing Amount and Location of Elongation Occurring in Forming the Engine Cowling Ring Illustrated in Fig. 4

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Free-Machining Alloy Steel Announced by Ryerson

A free-machining alloy steel known as "Rycut" is being made available by Joseph T. Ryerson & Son, Box 8000 A, Chicago 80, Ill. This steel is said to develop hardness comparable with that of S A E 4150 steel and to make possible savings of 25 to 50 per cent in machining time, compared with standard alloy steels. Other economies reported are longer tool life and less grinding required after hardening. 201

Plastic Spray Provides Corrosion Protection for Metal Parts

The Foster & Kester Co., Inc., Philadelphia 32, Pa., has brought out a transparent plastic coating for protecting metals, known as "Krylon," which is supplied in a self-contained compact sprayer. The coating dries in less than a minute, leaving a clear satin finish that retains the flexibility of the material on which it is applied and provides good resistance to discoloration at high temperatures and to the action of water, alcohol, alkalies, acids, mineral oils, grease, and chemical fumes. Parts sprayed with this product immediately after being machined are protected for an indefinite storage period. Fine instruments and tools can also be safeguarded against corrosion in the tool-room, shop, or storage bin. The coating can be removed by a special solvent supplied by the manufacturer. 202

Rubber Phenolic Compound Produces High Shock Resistance

High shock resistance can be obtained in instrument cases, knife handles, power tool handles, and other parts that undergo rough treatment, by the use of a new Hycar-phenolic molding powder developed by the General Electric Co.'s Chemical Department, Pittsfield, Mass. This compound, known as G-E 12446, possesses the good moldability and heat resistance of wood-flour filled phenolics, and is strengthened by the toughness and resiliency of Hycar-American rubber, a product of the B. F. Goodrich Chemical Co., to the point where it can replace cotton flock and rag filled compounds for many applications.

The inherent resiliency of the new material permits it to be molded around large complex inserts without danger of cracking, and around inserts subject to flexing and vibration. An additional feature of this rubber phenolic compound is its excellent thermal shock resistance, which permits molded parts to be subjected to an instantaneous drop over a wide temperature range without cracking. 203

High-Speed Bearing Bronze with Fibrous Structure

A non-granular bronze with needle-like structure is being manufactured by the American Non-Gran Bronze Co., Berwyn, Pa., for use in bearings. This alloy is said to be tougher, more resilient, of greater density, and to have a longer service life than bearing bronzes of granular structure. It is available in the form of castings and bar stock. 204

Plastic Pipe Having High Corrosion and Weather Resistance

The United States Rubber Co. has developed a corrosion-proof plastic pipe made of "Kralite"—a blend of synthetic rubber and thermoplastic resins—for use in chemical manufacturing, mining, and other industries. This pipe is made by a continuous extrusion process without the use of metal or fabric reinforcement. It can be bent to various radii and can also be threaded for fittings.

While this plastic pipe is more expensive than most types of metal pipe, it has the advantage of better resistance to chemical corrosion and weather. It is supplied in rigid and semi-rigid forms and in sizes ranging from 1/4 inch to 2 inches outside diameter................205

Laminated Cork and Rubber Material Isolates Vibration

"Elasto-Rib," a laminated rubber-cork material developed for low-cost vibration and noise control, has been brought out by the Korfund Co., Inc., 48-15 Thirty-Second Place, Long Island City 1, N. Y.

This new vibration-isolating material is composed of a layer of cork bonded between two layers of deep-grooved, oil-resistant, synthetic rubber. The ribbed contour of the rubber increases the isolation properties by providing greater deflection, and forms a non-skid contact with the floor. Recommended loading is between 7 and 21 pounds per square inch. 206

Phosphate Compound Permits Higher Wire-Drawing Speeds

A new phosphate material that inhibits rust and helps lubricate wire in process of manufacture is said to permit a 20 to 25 per cent increase in speed of drawing fine high-carbon wire. The new material, known as "Banox," is produced by Calgon, Inc., Pittsburgh, Pa. It has been in use at the Aliquippa, Pa., wire mill of the Jones & Laughlin Steel Corporation since June, 1947. While this is the first application of Banox in wire-drawing, it has been employed by manufacturers of household appliances, metal furniture, and automotive bodies and parts, as a rust-proofing and paint-bonding coating.

Protection of the wire against rusting during manufacture not only has permitted an increase in drawing speed but also has meant a sharp reduction in damage to dies and to wire and fewer delays for replacing dies. 207

Flaked Stainless Steel in Plastic Applied Like Paint

A product called "Liquid Stainless Steel" has been developed by the Plastics Division of the Lockrey Co., College Point, N. Y., for application to any surface by brushing or spraying, in much the same manner as paint is applied. The stainless steel is broken down into flakes of microscopic size by a new process, and this material is incorporated in a liquid plastic and solvent to bring it to brushing consistency. It can be used on all wood surfaces exposed to fresh or salt water or for household or industrial use, either decorative or protective. Liquid Stainless Steel exhibits good adhesion to both wood and metal, as well as to other surfaces, and is quick drying. 208

Liquid Plastic Developed for Plating-Rack Coating

A liquid plastic plating-rack coating designated "Enthonite 101" has been developed by Enthone Inc., 442 Elm St., Department M, New Haven, Conn. This material is supplied as a viscous liquid containing 100 per cent solids, so that there are no solvents to evaporate and all drippings can be reclaimed.

Coatings can be made from 1/8 to 1/4 inch thick, and are said to have high resistance to all types of inorganic solutions, particularly plating solutions. The surface produced is glossy, so that the plating solutions do not readily wet it, and considerable saving in the drag-out of solution is claimed. The coating is tough, resilient, and will not chip even when subjected to considerable abuse. 209

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in January, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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Broach Guiding Important in Producing Square Surfaces

THE broaching of large internal involute splines of 8 diametral pitch in the forged steel wheel hub seen in Fig. 1 presented an interesting problem in designing the tool for the job. The splines had to be square with a face at the opposite end of the part as it is shown in the illustration. The problem arose from the fact that the length of broach necessary resulted in deflection of the tool and made it difficult to keep the splines square with the face. Tool deflection was overcome by guiding the broach

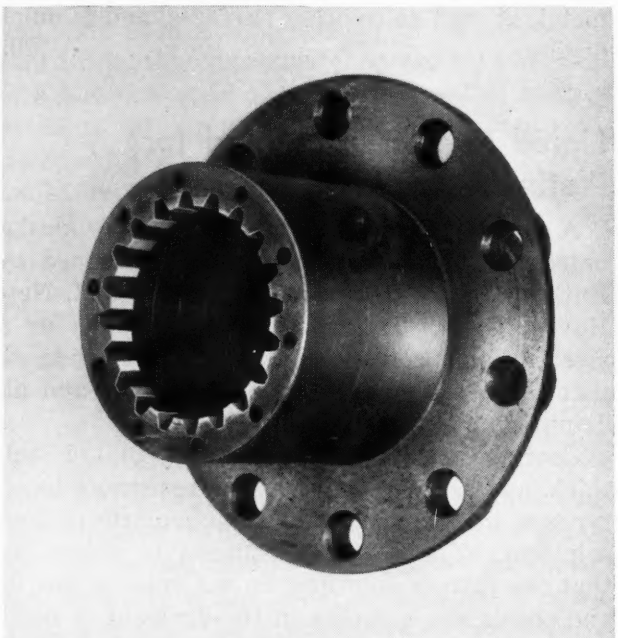


Fig. 1. Twenty Splines, of 8 Diametral Pitch, are Broached Square with a Face at Opposite End of This Forged Steel Wheel Hub

close to the work-piece. The tooling for the job was developed by the Colonial Broach Co., Detroit, Mich.

The front face of the forged wheel hub, as seen in Fig. 1, is placed downward in the fixture illustrated in Fig. 2. The face with which the spline has to be square is at the other end of the part, as mentioned previously, which is the top of the part as shown in Fig. 2.

To hold the squareness within the required tolerance, the fixture guides the broach both above (in the cross-arm) and below the part. In each location, four inserts—spaced 90 degrees apart as illustrated in Fig. 3—are used. These register in four grooves which are ground lengthwise of the broach between the spline cutting teeth.

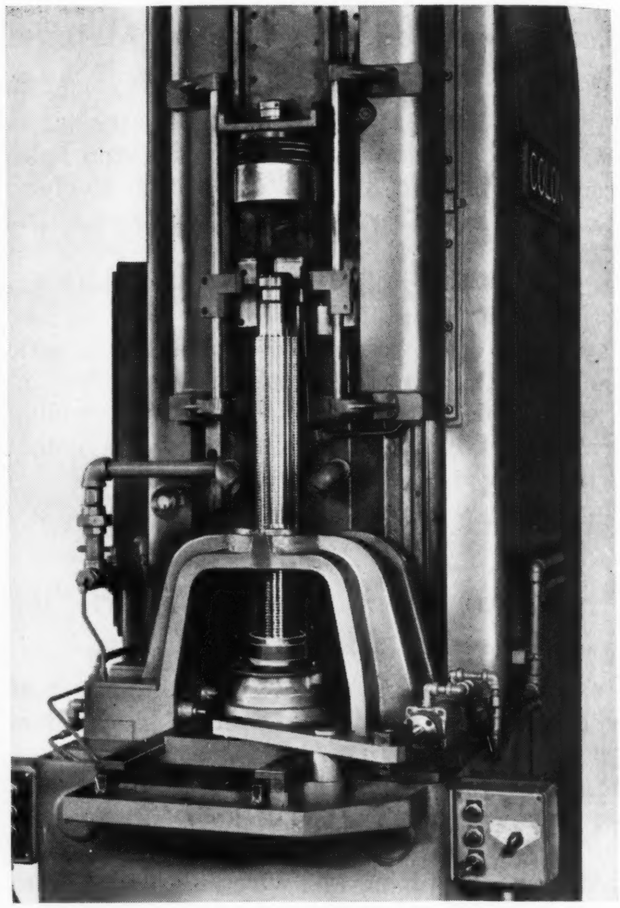


Fig. 2. Pull-down Broaching Machine Equipped with Broach Guides above and below the Work-piece

The machine is of the "pull down" type. It is of 15 tons capacity and has a 60-inch stroke. The platen is equipped with a special receding table to simplify loading. Movement of the table is interlocked with the machine cycle, so that the machine cannot start its cutting stroke until the part has been shuttled into position.

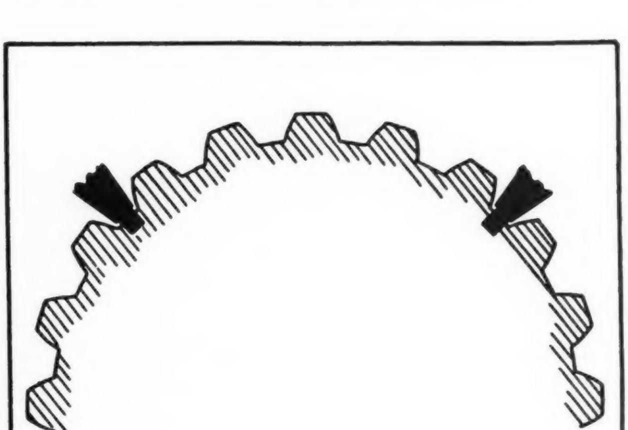


Fig. 3. Cross-sectional Diagram of Broach and Guide Inserts which Engage Grooves in Broach

All machine operations are hydraulically actuated. The operating cycle is as follows: Part is loaded with table in receded position; table shuttles into cutting position; broach moves down into puller and is pulled through part; table recedes for unloading of part and to clear broach; broach is returned to top of machine and engages in holder; machine stops until reloading has been completed and table has been shuttled back into cutting position.

Unification of Screw-Thread Standards

INTERNATIONAL trade in mechanical products of various kinds has long been handicapped by lack of interchangeable screw-thread parts. An important step in eliminating this commercial barrier has been taken by the United Kingdom, Canada, and the United States by the unification of the American and British (Whitworth) standard screw-thread systems. This unification involves certain changes in both the American and British standards.

The included angle of the unified thread in the axial plane is 60 degrees, like the present American standard. The unification agreement calls for rounded roots on external threads and flat crests on internal threads. However, certain details relating to the thread form remain optional. For example, the crests of external threads may be either flat, as in the present American standard, or round, as in the British standard. For external threads, a flat crest is preferred in American practice and a rounded crest is preferred in British practice. The internal thread in American preferred practice has a flat crest and root, whereas the British preferred form has a round root and flat crest. These variations in form do not interfere with the interchangeability of the screw threads. Fatigue tests at the National Bureau of Standards subject screw-thread specimens to forces simulating the vibration encountered in many screw-thread applications. These tests indicate that rounded root contours on bolts, as called for in the Unified Screw-Thread Standard, make the fatigue type of failure less likely.

The sizes agreed upon, the threads per inch, and the basic dimensions insure unification among the American, British, and Canadian Unified Standards with the exception, at the present time, of the 1/2-inch size in the coarse-thread series. The tables as now published contain a 1/2-inch size having 13 threads per inch (like the present American Standard) and also a 1/2-inch size having 12 threads per inch (like the present British Standard). The latter evidently will be included in the tables for unified screw threads, but will not constitute part of the American Standard.

The minimum internal thread of the Unified Standard is basic, and the allowances (or minimum clearances on the flanks of threads) are to be applied to external threads. Tolerances are minus for external threads and plus for internal threads. This system insures complete interchangeability of threaded parts.

The Unified Standard includes tolerances and allowances for providing three general grades or classes of fits between external and internal screw threads. The class designations are 1A and 1B (A representing external, and B internal threads); 2A and 2B; 3A and 3B. Class 2A represents a recognized standard in the United States for bolts and screws, and Class 2B applies to nuts. These classes, however, are suitable for a wide variety of other applications.

The basic formula from which allowances on all diameters and tolerances on pitch diameters are derived is:

$$\text{Tolerance} = C(0.0015\sqrt[3]{D} + 0.0015\sqrt{L_e} + 0.015\sqrt[1.5]{p}) \text{ (or allowance)}$$

In this formula, C is a factor that differs for each allowance or tolerance in each class; D is the basic major diameter; L_e is the length of engagement; and p is the pitch. The formula is based on the accuracy of present-day threading practice, and is applicable to all reasonable combinations of diameter, pitch, and length of engagement.

The values of the factor C for *allowances* are as follows (allowance is defined as minimum clearance or maximum interference, as the case may be):

Class	Factor C
1A	0.450 or 0.300
2A	0.300
3A	0.000

The values of the factor C for pitch diameter *tolerances* are as follows:

Class	Factor C	Class	Factor C
1A	1.500	2B	1.300
1B	1.950	3A	0.750
2A	1.000	3B	0.975

The relative difficulties of manufacture were provided for by making the value of factor C

30 per cent greater for internal than for external threads of a given grade of fit, as shown by the factor C values listed.

The application of the formula will be illustrated in connection with the 1-12 screw thread in the fine-thread series, Class 2A and Class 2B.

Factor C for pitch diameter *tolerance*, Class 2A, equals 1. The tolerances are based upon a length of engagement L_e equal to the nominal major diameter of the external thread. Hence, for Class 2A (external thread):

$$\text{Tolerance} = 1 \times (0.0015 \times \sqrt[3]{1} + 0.0015\sqrt{1} + 0.015 \times \sqrt[1.5]{0.0833}) = 0.0059$$

For Class 2B (internal thread), the only change is in the value of factor C which, as the table shows, is 1.300. Hence,

$$\text{Tolerance} = 1.300 \times 0.0059 = 0.0077$$

Factor C for determining *allowance* 2A is 0.300, and as the other values remain unchanged,

$$\text{Tolerance} = 0.300 \times 0.0059 = 0.0018$$

A few details still remain to be agreed upon. An Editing Sub-committee, consisting of representatives of the three nations, was appointed by the Sectional Committee B1 on the Standardization and Unification of Screw Threads at its meeting on November 18, 1948. This sub-committee was authorized to resolve, within specified limitations, the differences which remain. Any agreements reached will be incorporated in the American standard without further formal action by the three governments.

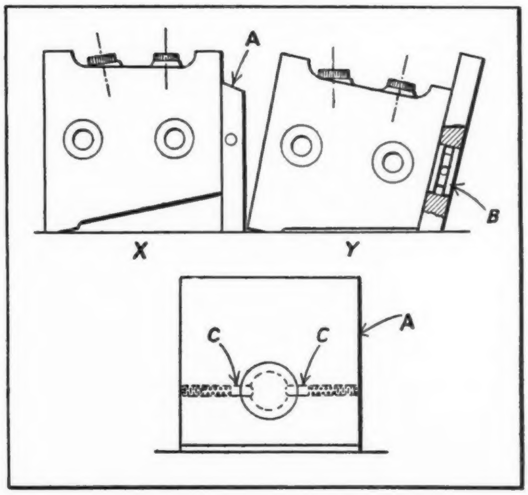
According to a National Bureau of Standards report, purchases of mechanical products by the three governments involved will be based upon this Unified Standard; however, industrial applications within the normal commerce of each of the three nations will require a transformation of practices involving considerations of engineering, design, tooling, and production. Such changes must be the result of a gradual transition and will require a period of years.

In establishing this Unified Screw-Thread Standard, the initial step naturally pertains to the most commonly used type of screw thread, but there are other important types that remain to be standardized. In the case of Acme and Buttress threads, the unification of standards has reached an advanced stage. Further, standardization of drawing-room practices within the countries and their unification among the countries are essential if there is to be an interchangeability of blueprints and production drawings. In these and related fields, the three governments concerned, and the respective standardization organizations, are carrying on continuing programs.

Reversible Jig Foot for Drilling Straight and Angular Holes

The reversible jig foot shown in the illustration can be used in drilling either straight or angular holes. Since it is permanently attached to the side of the jig, there is no danger that it will be mislaid or lost, or that it will impede the operator in his work by requiring too much set-up time.

The foot A is made of steel plate. It swivels on a grooved stud B in the jig, and is held in place by two plunger pins C. These plunger pins fit into detent locating holes and are held in place by set-screws and two small coil springs. When the pins drop into place, the foot is correctly located for drilling either a straight or an angular hole. The view X shows the position for the straight hole, and view Y for the angular hole. Nothing protrudes beyond the face of the foot to interfere with the drilling of holes from the opposite side.

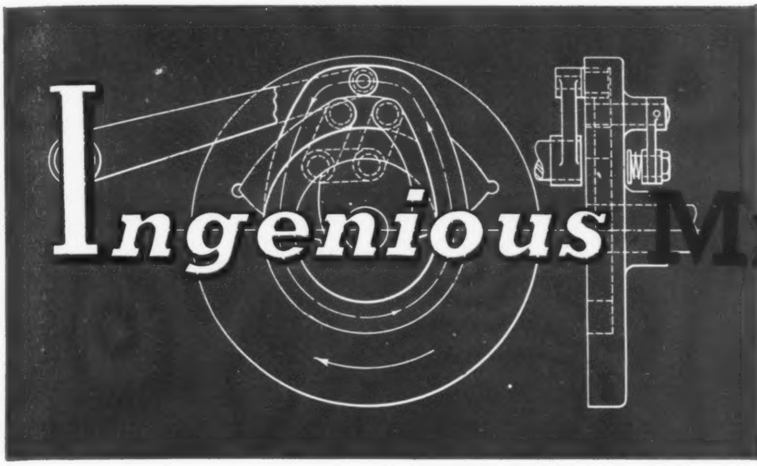


Reversible Jig Foot which Permits Drilling Straight or Angular Holes

* * *

Management and Merchandising Conference

A management and merchandising conference sponsored jointly by the Wharton School of Finance and Commerce, University of Pennsylvania, and the Machinery Dealers National Association, whose headquarters are in Chicago, was held recently at the Penn Sheraton Hotel in Philadelphia. On the program were sixteen lectures on technical subjects, presented by buyers of used machine tools, machine tool dealers, professors of marketing, and specialists in general business subjects.



Ingenious Mechanisms

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Gear and Link Mechanism for Synchronized Horizontal and Vertical Motion

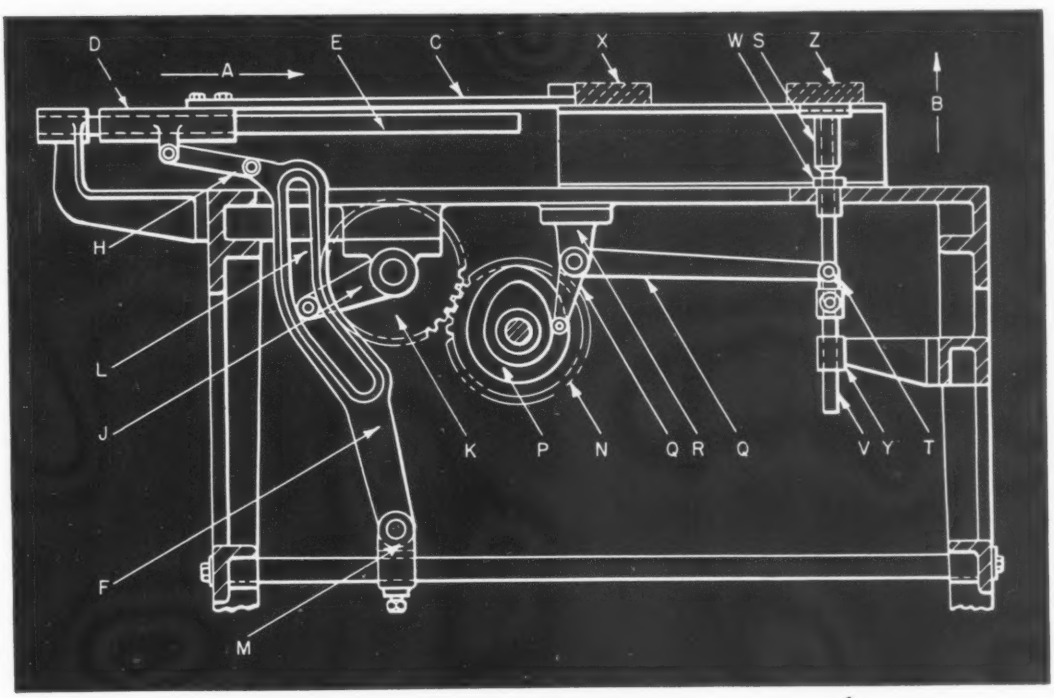
By F. H. MAYOH

The mechanism shown in the accompanying illustration was designed to move work horizontally to a position where a vertical lift is applied. Referring to the illustration, the work *X* is to be moved in the direction indicated by the arrow *A*. Upon reaching position *Z*, the work is raised, as shown by the arrow *B*.

The horizontal pushing plunger *C* is attached to a slide *D*, which moves along two rods *E* when pulled by the lever *F* through the medium of the connecting link *H*. A crank *J*, rotating with gear *K*, operates in a slot *L* in the lever *F*, thus moving the lever so as to actuate the plunger slide to the right and left. Lever *F* is secured by means of a pivot to a stationary sleeve *M*, which is attached to a tie-rod in the base of the machine.

Gear *K* is driven by gear *N* in which there is a cam groove *P*. The purpose of the cam groove is to operate the bellcrank lever *Q*, which is attached by a pivot to the fixed bracket *R*. The movement of the bellcrank lever causes the lifting plate *S* to be carried up or down on the rod *V*, which is connected to the bellcrank lever by means of the linkage shown at *T*. Bearings at *W* and *Y* guide the lifting rod.

Timing of the horizontal and vertical movements relative to each other is accomplished by proportioning the slot *L* in lever *F* so that the



Schematic Diagram of Gear and Link Combination for Synchronized Horizontal and Vertical Motion

forward movement of the work in the direction of arrow A is accelerated and then decelerated gradually as the crank J travels in the slot. A quick return stroke is provided by the angular section of slot L. The cam groove P in gear N is so positioned that lifting of the work at Z takes place during the return movement of lever F and plunger C.

* * *

Mechanism for Changing Cam Speeds Independently of Camshaft Speeds

By L. KASPER

A mechanism for reducing the rotary speed of a cam without altering the speed of the shaft on which the cam is mounted is shown in the illustration. This mechanism was applied to a machine for winding flat wire on spools. The wire-guiding mechanism was required to be operated by a uniform-motion cam, maintaining a definite rate of travel over a specific distance.

Because of a reduction in the width of the flat wire being spooled, it became necessary to decrease the rate of travel of the guiding mechanism by approximately one-third without altering the distance traversed or the speed of the camshaft, which operated other mechanisms.

To accomplish the required difference in rotary speed between the cam and its shaft, gear teeth were machined in the bore of the cam C to engage a spur gear B, which was assembled to the shaft A. The ratio of internal gear teeth to the spur gear teeth was made approximately 3 to 2. Thus the cam, which rotates about center line Y—Y, revolves at two-thirds the speed of the shaft, which rotates about the original center line X—X. In this way, the follower roll D, which actuates the wire-guiding mechanism, is driven at one-third the speed of shaft A.

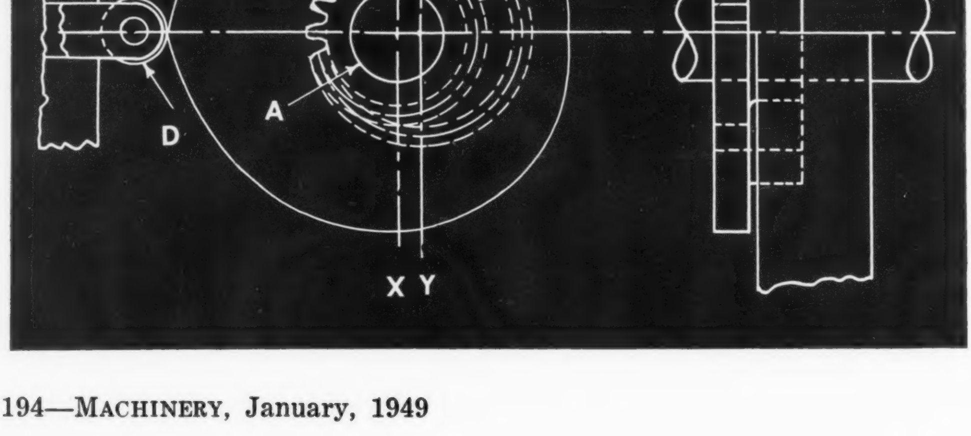
* * *

New Britain Machine Co. Acquires the Lucas Machine Tool Co.

The plant and certain other assets of the Lucas Machine Tool Co., forty-nine year old Cleveland manufacturing concern, have recently been purchased by the New Britain Machine Co., New Britain, Conn. An announcement to this effect has been made by McDonald & Co., Cleveland, and R. S. Howe, vice-president of the New Britain Machine Co. The operation of the Lucas Division will be continued at Kirby Ave. in Cleveland by the present personnel and under the direction of H. N. Stephan, who was vice-president and general manager of the Lucas Machine Tool Co.

* * *

A new research laboratory of the General Electric Co. being constructed at a total cost of $18,000,000 is nearing completion at Niskayuna in the vicinity of Schenectady, N. Y. It is expected that the laboratory will be formally dedicated in 1950 in conjunction with a fiftieth-anniversary celebration to mark the founding of the first laboratory by Dr. Willis R. Whitney. That laboratory was in a barn at the late Dr. Charles P. Steinmetz's home.



Internal and External Spur Gears Permit Reduction of Cam Speed Independently of Camshaft Speeds

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Drilling Square Stock on an Automatic Screw Machine

By F. J. WATRAL, Manufacturing Engineer
Westinghouse Electric Corporation, East Pittsburgh, Pa.

So-called "second" operations on screw machine products usually add considerably to the cost of the parts and often slow up the entire machining cycle. Such was the case with the square contact lug shown in Fig. 1, which was being machined on an automatic screw machine at the rate of 180 pieces per hour, and was then routed to a drill press, where a side hole was drilled at the rate of 100 pieces per hour.

To eliminate the second operation and free the drill for other production, a standard Brown & Sharpe index drilling attachment was adapted for use on the screw machine by a few simple changes. In place of the 3/8-inch belts and pulleys originally supplied with the attachment, 1-inch wide flat linen belts were used in order to pull the load; an idler pulley was added to the attachment drive; and additional clearance was provided in the square attachment chuck for more efficient chip removal.

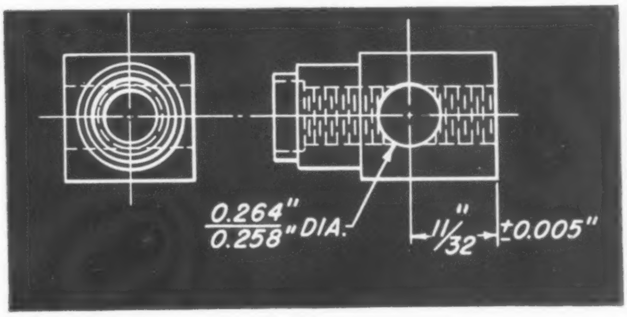


Fig. 1. A Typical Square Contact Lug that is Drilled on an Automatic Screw Machine Equipped with an Index Drilling Attachment

When the attachment is in operation, the piece is picked up by the transporting mechanism shown at *A* in Fig. 2 and inserted in the square attachment chuck *B*, operated by a small cam that closes the spring chuck. As soon as the chuck is closed, the transporting lever is released and a cam operates the drill *C*. After the hole is drilled half way through, another cam indexes the chuck to bring the opposite side of the work into the correct position for completing the drilling of the hole.

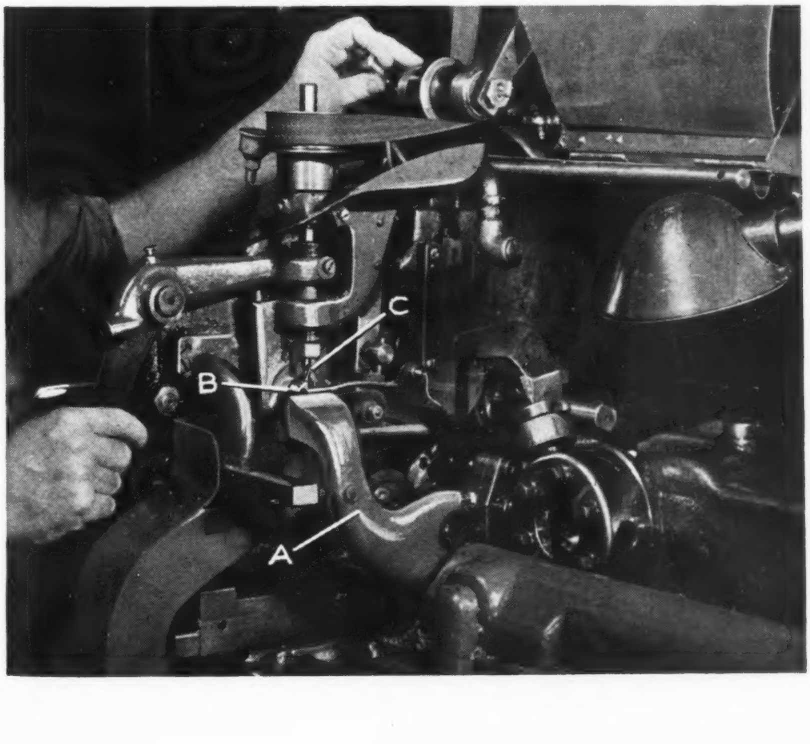


Fig. 2. The Index Drilling Attachment Applied to the Automatic Screw Machine. Part A is the Transporting Mechanism, Part B the Chuck, and Part C the Auxiliary Drill

The application of this method of drilling is an interesting feature of the square-piece drilling attachment. If the hole were drilled through in one operation, a burr would be produced on the opposite side of the piece, thus preventing the ejection of the drilled part; the slight burr resulting from the drilling of the inside of the tapped hole does not interfere with the final assembly. On completion of the drilling operation, the chuck cam operates the mechanism to release the spring chuck, and by use of a spring plunger, the piece is ejected from the chuck. The plunger then returns to its original position, leaving the chuck open, ready for the insertion of the next piece.

The reverse shaft of the machine drives the attachment camshaft and rotates it in time with the other cams of the machining set-up. The drill chuck on the attachment can accommodate drills up to 9/32 inch in diameter.

As a result of the application of this attachment, considerable savings were realized. The output of the machine is not reduced, since the allowed time per piece was not increased and the production remained at 180 completely machined parts per hour. In addition, the machine and operator previously required for the second drilling operation were made available for other work. Since the lugs are produced in large quantities, the savings resulting in the first year of operation actually amounted to more than twice the cost of the fixture.

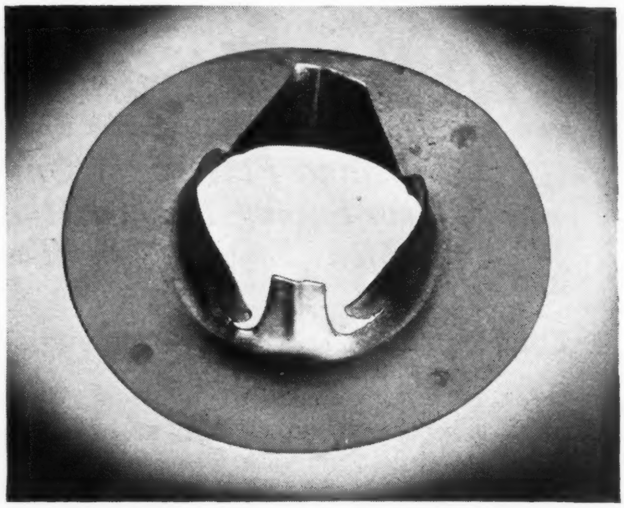


Fig. 1. Small Brass Oil-Guard of Unusual Shape, for which the Punch and Die Illustrated in Fig. 3 was Designed

Punch and Die for Forming an Unusual Shaped Piece

By ROBERT MAWSON, Providence, R. I.

The small oil-guard illustrated in Fig. 1 is made of very thin brass sheet—0.005 inch thick—and is designed with four ears of irregular shape that project at right angles to the flange. To form these ears, two of which must be grooved to allow oil flow, the Sterling Tool Co., Central Falls, R. I., recently constructed an un-

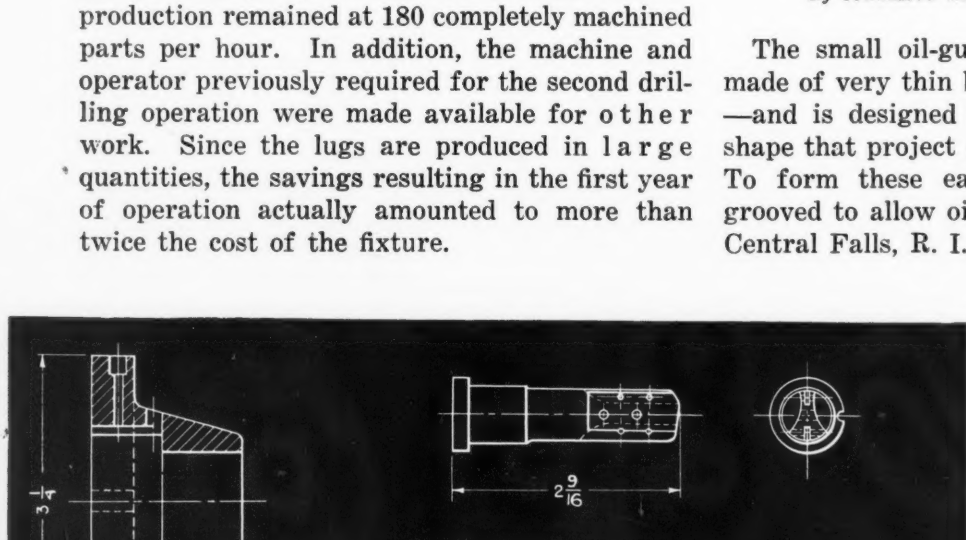


Fig. 2. Details of Parts for Punch and Die Assembly, Showing Punch Nest A, Punch C, Stripper D, Inserts F and G for Forming the Projections and the Oil-grooves, Respectively, and Die H

usual punch and die that actually bursts the blank and forms the projections. Details of this punch and die are shown in Figs. 2 and 3.

The assembly consists of a punch nest *A* and a punch-block *B* into which is driven the punch *C*. A stripper *D* is provided to remove the piece after it has been formed. Four pins *E*, which are made a drive fit in the stripper, punch the depressions in the flange for locating and mounting the guard. All parts, with the exception of the punch-block *B*, are made of hardened and ground tool steel.

Special inserts attached to the punch are used to form the projections and the oil-grooves. Two of the inserts *F* for forming the projections are held in grooves in the punch by fillister-head screws that pass through one insert and the punch and are screwed in tapped holes in the mating insert. The remaining two inserts *G* are fitted into machined slots in the punch, and are held in position by drive pins.

The die *H* is assembled in the die-head *J*. Four knock-out pins *K*, each actuated by a spring in the conventional manner, are also mounted in the die-head. It can be seen from the assembly view that the die is the top and moving member, while the punch is at the bottom and remains stationary.

On top of the punch and die is placed a machine-steel plate *L* on which is mounted a Bellows air motor that operates the tool. A spring that acts as a cushion for the die is enclosed in shank *M*. Stripper *D* is raised by a hardened steel pin, the motion being obtained from the lower spring, the tension of which can be adjusted by moving the nut up or down on the rod that passes through the spring. The stripper is kept in alignment by a steel key.

In operation, a blank is placed in the 1.1255-inch opening in the punch nest *A*, after which the air motor is operated to actuate plate *L* and force the punch down. The blank is burst, and further movement of the die completes the forming of the ears, makes the punch marks in the flange, and forms the oil-grooves.

On release of the air pressure, the die returns to its original position, and the compression spring below the bottom plate forces up the stripper and the formed part. When the piece comes in contact with the knock-out pins, it is automatically removed from the punch.

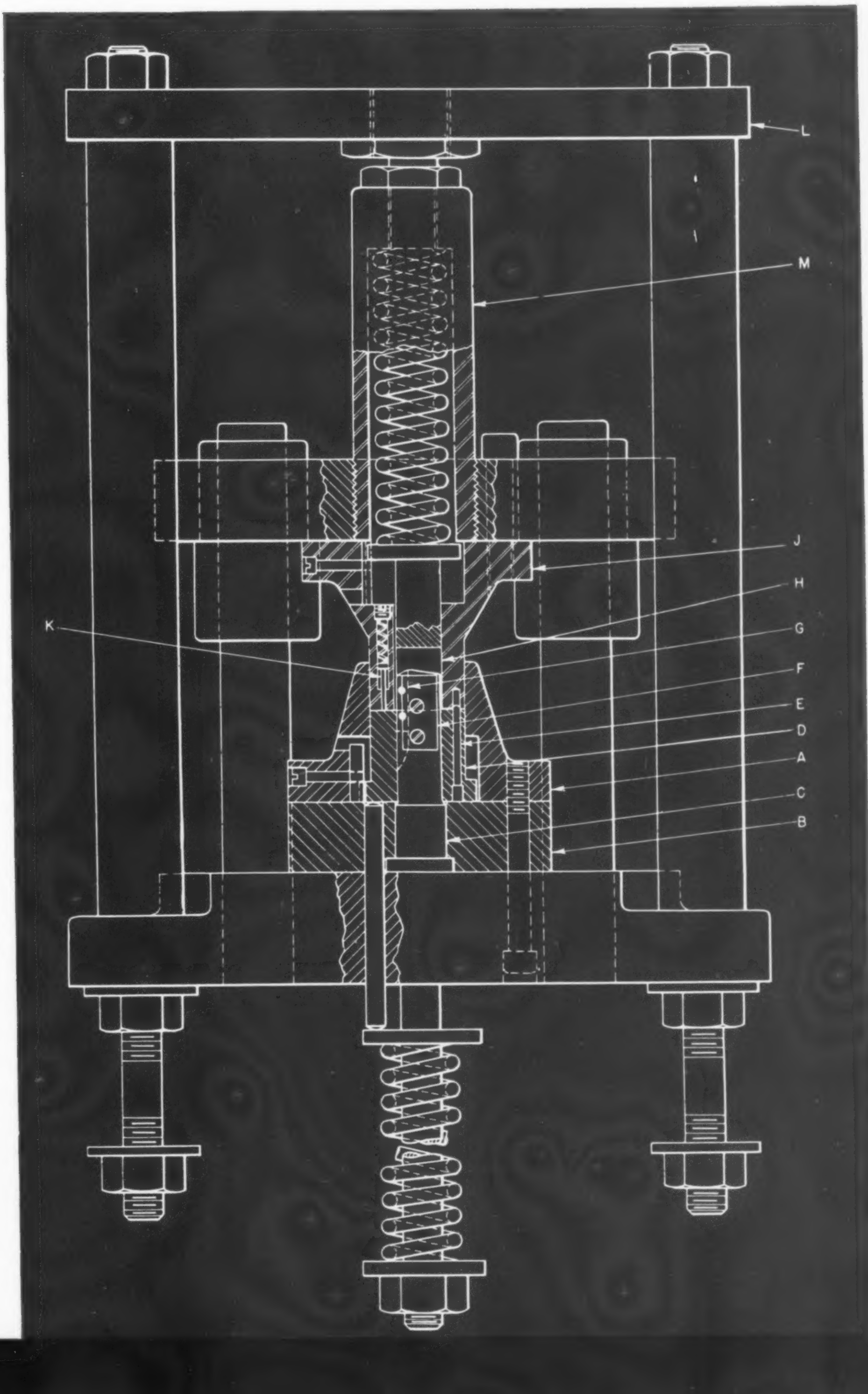


Fig. 3. Assembled View of Punch and Die Used in Forming the Part Shown in Fig. 1

Locating Scriber for Marking Center Lines on Opposite Sides of a Shaft

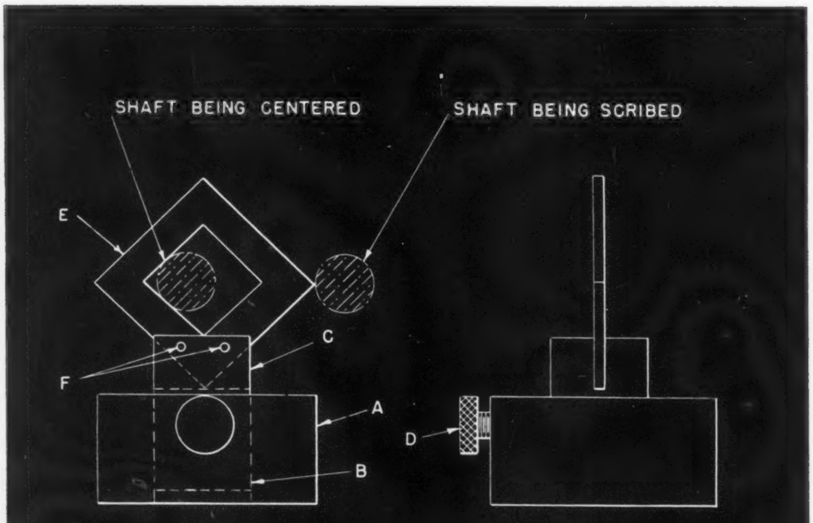
By H. MOORE, Leeds, England

A common yet difficult marking operation is the scribing of two center lines on opposite sides of a shaft. To do this in the shortest time, it is necessary to disregard the usual method of surface-gage scribing, with its trial and error height findings, and to adopt a quick locating scriber like the one shown in the accompanying illustration.

The base *A* is a piece of round steel through which hole *B* has been drilled and reamed; the scriber-holder *C* is machined to a sliding fit in this hole. These two parts are held together by a knurled screw *D*. The scriber *E* is made of hardened flat gage steel; it is machined square, inside and out, and fastened in the slot in the scriber-holder by pins *F*.

When in use, this scriber is first placed with the inside square over a protruding end of the shaft to be marked. The holder is then adjusted up or down until one of the horizontal corners of the inside square fits against the shaft, after which the screw is tightened. The device is then ready for use, either one of the outside horizontal corner points being in position to scribe a center line.

If carefully made, this scriber is very accurate and long lasting. It is applicable to all work held in a V-block, and can be used to locate and mark a center line in much less time than is possible with the usual methods.



Device Used to Quickly Locate and Scribe the Center Line on Two Sides of a Shaft

Press and Forging Machine Manufacturers Eligible for Membership in N.M.T.B.A.

The National Machine Tool Builders' Association, on December 15, 1948, adopted an amendment to its constitution which makes manufacturers of power-driven metal-forming equipment eligible for membership in the Association, as well as builders of metal-cutting machine tools. The amendment reads as follows:

ARTICLE II

Purpose—The purpose of this Association is to promote the lawful interests of the metal-cutting and metal-forming machine tool industry (known as the machine tool industry) in the direction of good business ethics; the liberal discussion of subjects pertaining to improvement, standardization, and the methods of manufacturing and marketing machine tools.

ARTICLE III

Membership—Section 1. Any individual, co-partnership, or corporation that shall have been engaged within the United States for one year or more in the manufacture of machine tools as they are defined below is eligible for membership.

(a) *A Metal-Cutting Machine Tool* is a power-driven machine, not portable by hand, used for the purpose of removing metal in the form of chips.

(b) *A Metal-Forming Machine Tool* is a power-driven machine, not portable by hand, used to press, forge, emboss, hammer, blank, or shear metal. NOTE: This definition of a metal-forming machine tool does not include die-casting machines, extruding machines, rolling mills, or welding equipment.

* * *

The first boatload of German steel scrap sent under a contract recently made by the Carnegie-Illinois Steel Corporation, subsidiary of the United States Steel Corporation, reached the United States last September. This consignment amounted to 9438 tons of No. 1 heavy melting steel scrap, which is a better grade than is generally available from domestic sources. It is already processed and therefore ready for use in open-hearth furnaces. The Carnegie-Illinois Steel Corporation has an option for additional tonnage of steel scrap, which should bring its purchases to more than 200,000 tons.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

How Can Gear Noises be Reduced?

A. C. K.—We are using modified Type 4615 S A E steel in transmission gears. These gears operate satisfactorily, but are extremely noisy in some cases. Can you suggest some means for preventing or correcting this condition?

Answered by Editor, "Nickel Steel Topics"
International Nickel Co., Inc., New York City

Noisy gear transmissions result primarily from the use of gears that have become distorted during heat-treatment, provided the gears have been correctly cut. Opinion today seems to be that the best practice to minimize the distortion is to heat the blank to between 1700 and 1800 degrees F. and cool slowly either in the furnace or the open air so that full lamellar pearlite with large grain results. This structure permits free machining and allows the machined gear to be heat-treated with a minimum of distortion. Most 4615 steel gears are box quenched and held to a hardness of approximately 60 Rockwell C.

Intricately shaped gears usually are box cooled from a carburizing heat of 1650 degrees F., and are then reheated to about 1475 degrees F. and quenched in oil. General practice is to leave all carburized gears over 60 Rockwell C untempered. If tempering is necessary, it should be done at from 275 to 325 degrees F.

Manufacture of Socket Wrenches

G.G.A.—We would appreciate suggestions on how to manufacture the socket wrench shown in Fig. 1. The material to be used is chrome-vanadium steel and the wrenches are to be made in large quantities; we are particularly interested in the best method of forming the twelve-sided interior socket and square hole.

A.—One way of producing the wrench would be to make it in two parts, as indicated in Fig. 2, and copper-braze the parts together after final machining. Thus, the square and twelve-sided socket holes could be formed with a simple multi-tooth pull-through or push-through broach.

Copper-brazing in a controlled-atmosphere furnace will produce a joint of adequate strength, and once the equipment is installed, the operation can be performed rapidly. No subsequent descaling or cleaning operations would be necessary on the work. Note, however, that the diameter of the socket having the square hole must be reduced in order to allow a thicker wall in the large socket section of the wrench.

Before undertaking this procedure, of course, the effect of the high brazing temperature (over 1800 degrees F.) on the particular chrome-vanadium steel to be employed for this job should be investigated.

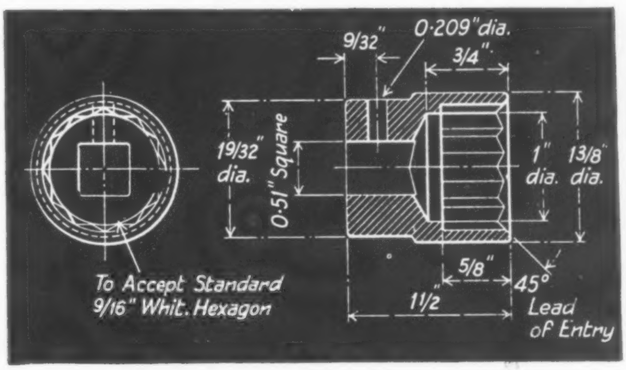


Fig. 1. Socket Wrench to be Manufactured

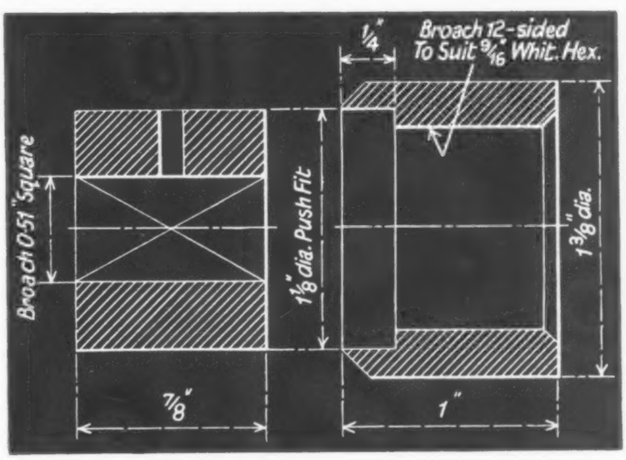


Fig. 2. By Making the Wrench in Two Parts as Shown and Copper-brazing the Parts together after Final Machining, the Square and Twelve-sided Socket Holes Can be Produced by a Broaching Operation

James E. Gleason Honored on Eightieth Birthday

MEN prominent in the machine tool industry and in the civic affairs of Rochester joined with the personnel of the Gleason Works, Rochester, N. Y., on November 24 to celebrate the eightieth birthday of James E. Gleason, chairman of the board. During a program held in the afternoon, the greetings of the city of Rochester were extended by the vice-mayor. Following the vice-mayor's remarks, Tell Berna, general manager of the National Machine Tool Builders' Association, addressed the gathering, after which Lloyd D. McDonald, president of the Association, brought Mr. Gleason the best wishes of the machine tool industry.

Honorary membership in the Rochester Engineering Society was conferred on Mr. Gleason, who is the third person to receive an honorary membership in the fifty-one years of that Society's existence. Telegrams of congratulation from all over the world and from a majority of the states in this country were then read. Following these messages, E. Blakeney Gleason, president of the Gleason Works, presented his father with four volumes containing congratulatory letters.

Mr. Gleason was also presented with a book signed by everyone associated with the Gleason Works; a pendent type barometer was given by the members of the Twenty-Five Year Club; the Employes' Mutual Benefit Association gave a leather smoking set; and the Gleason Works, through Arthur L. Stewart, vice-president, presented a large hand-tooled sterling silver bowl. During the evening, the Gleason Works held open house from 7 to 10:30 P.M., and was visited by many friends of Mr. Gleason and the families of the employes.

James E. Gleason was born on November 25, 1868, in Rochester, and attended public school and Hale Academy in that city before entering Cornell University to study mechanical engineering. After his return to Rochester, Mr. Gleason worked with his father, the late William Gleason, in designing and building lathes and planers, and bevel and spur gear planers.

In 1905, James E. Gleason took out patents on a two-tool bevel-gear generator—a machine that cut both sides of bevel-gear teeth simultaneously. Up to this time, bevel-gear teeth were cut on a planer that worked on one side of a tooth at a time. In 1913, Mr. Gleason developed the spiral bevel-gear generator, which contained many elements embodied later in the hypoid-gear generators also developed by the Gleason Works.

Mr. Gleason was president of the National Machine Tool Builders' Association from 1926 to 1927. In May, 1939, he was presented with the Civic Medal by the Rochester Museum of Arts and Sciences for notable achievements in the field of industrial science; in December, 1939, he was awarded the medal of the American Society of Mechanical Engineers for "service to the cause of safer and better transportation"; and in February, 1940, he received an award from the National Association of Manufacturers in recognition of his far-reaching inventions of machines for making new types of gears.

James E. Gleason, upon the Occasion of His Eightieth Birthday, with Mrs. Gleason and their Son, E. Blakeney Gleason

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

When The Sales Engineer Encounters Trouble

NO machine—no matter how well designed and built—is free from trouble. Each falls into human hands and is subject to human variables. But when there is trouble with a machine in use, the sales engineer can frequently turn the situation into an opportunity rather than a headache for himself.

Recently a cut-off grinder suddenly gave trouble after several weeks of successful operation. The engineer who sold it found a new operator cursing the machine. The operator—not the machine—was at fault, but the machine received the initial blame. Since most machine tools are a link in a production chain, the effect of failure is multiplied. The operation of a group of machines, even of an entire plant, may be interrupted. Machine failure, no matter what the cause, has vital significance.

The best way for a sales engineer to keep out of trouble from machine failure is to first educate the purchaser on the use of the machine and the operator on the technique of handling it. Then if trouble is reported, remedy the situation without delay.

These pointers may be helpful when the sales engineer meets trouble with equipment he has sold:

1. To start with, remember that failure in the operation of a machine makes the purchaser's consciousness suddenly jump to a peak of intensity. His attention is fixed on that one machine, on you as the salesman, and on the builder you represent. Your consciousness and your serious interest must likewise rise to his level.

2. Immediate and thorough investigation of the trouble is job No. 1. The purchaser is feverishly watching you. If you avoid him or delay your action, his confidence tumbles. Publicity gets in its work—poison germinates and spreads like an epidemic, alike to other users and prospects.

3. When trouble is initially reported, perhaps by telephone, get the facts clearly, one by one. Determine all the operating conditions and find out exactly what happened. If some part of the machine has failed, identify it carefully and waste no time in getting the replacement. Sometimes temporary action can be taken to preserve some degree of production.

4. Make sure that the purchaser knows how to reach you quickly. Annoyances from failure to get help promptly aggravate the trouble in the customer's mind.

5. Make an ally of the operator assigned to the troublesome machine. His regard for the machine is crucially important. Blaming him only lessens this regard. Help, diplomatically given, wins his friendship and engenders a real desire to make the machine work right.

6. Follow up every case of trouble past the point of correction, just as a good doctor follows his convalescing patient. An inquiry by telephone, a succeeding visit, will go a long way toward lifting the purchaser's confidence to a higher point than ever before.

7. After the trouble has been corrected and all goes well, sell the results of your service. This customer may have thought that he bought only a machine from you. What he actually bought is profitable results from the use of your tool. Service that supports continuity of operation must be sold, just as the results of the tool itself are sold.

Each one of us has probably experienced what a critical emergency may do to establish friendship. A slight acquaintance of long standing may suddenly become an intimate friend through some alarming event. Just so, friendships may develop from apparatus trouble that are of untold value to the sales engineer. Even a little help at the right moment counts far more than a whirlwind of sales talk.

Recently, the top machine tool purchaser for a very large metal-working manufacturer was severely criticised by his management for placing so large a share of requirements for a cer-

tain type of machine tool with one manufacturer. In his defense, he cited the way the sales engineer who represented this supplier had handled a very serious case of trouble. The prompt correction of the trouble and the sales engineer's follow-up had saved the company many thousands of dollars. After this explanation, the management had nothing to say. Note particularly that they did not even ask why and in what way the machine tool had failed.

* * *

What is the Gear-Cutting Capacity of this Country?

A survey to determine the gear-cutting facilities of the entire country is being made by the American Gear Manufacturers Association at the request of the National Security Resources Board. The purpose of this survey is to obtain information that will be invaluable in preventing gears from becoming a bottleneck in the event of another national emergency.

About seven hundred questionnaires were recently mailed by the A.G.M.A. to gear manufacturers. However, the Association does not possess a list of all manufacturers who have gear-cutting machines in their plant, especially manufacturers whose products are not primarily gears. That would include manufacturers of automobiles, household appliances, machine tools, or any other products having gear mechanisms. Newbold C. Goin, executive secretary of the American Gear Manufacturers Association, asks that manufacturers who have not received one of these questionnaires write to him for a copy. His address is Empire Bldg., Pittsburgh 22, Pa.

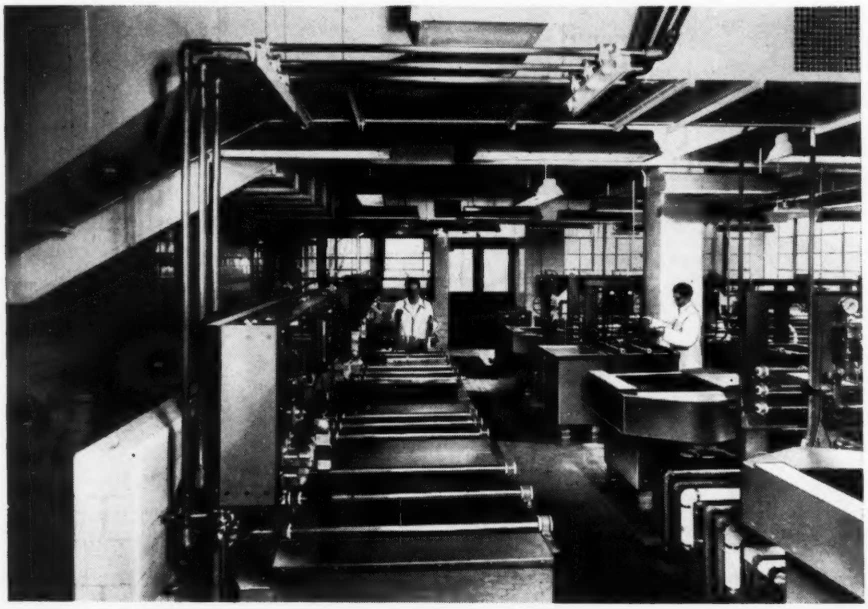
New Research Laboratory for Electroplating Industry

The Hanson-Van Winkle-Munning Co. recently opened a new electrochemical research laboratory in Matawan, N. J. The three-story laboratory, which has more than 15,000 square feet of floor space, contains advanced facilities for research and development in the electroplating industry.

Equipment in the plating room on the first floor includes complete apparatus for experimental and sample cleaning, pickling, plating, and anodizing. Instrument control and flexibility in the arrangement of apparatus so as to permit alterations to meet changing needs were major considerations in the development of the laboratory. Current is supplied by two direct-current motor-generator sets, one with a 1500-ampere capacity at 6 to 12 volts, and the other with a 500-ampere capacity at 40 volts. A view of the plating room is shown in the illustration.

On the second floor, there is a large analytical laboratory used primarily for customers' service, involving the analysis of plating solutions and investigating difficulties encountered in the application of electrodeposits. This laboratory is devoted to the investigation of new products and processes and to studies of problems related to metal finishing. Other facilities on this floor include a dark room, a balance room, a metallographic laboratory, and offices.

In the right wing of the second floor is a laboratory for investigating, developing, and testing polishing and buffing compounds and materials. A special precision buffing machine is used for the evaluation of buffing and coloring compositions, as well as for field research.



Partial View of Experimental Plating Room at New Hanson-Van Winkle-Munning Electrochemical Research Laboratory

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Gorton Horizontal Production Milling Machine

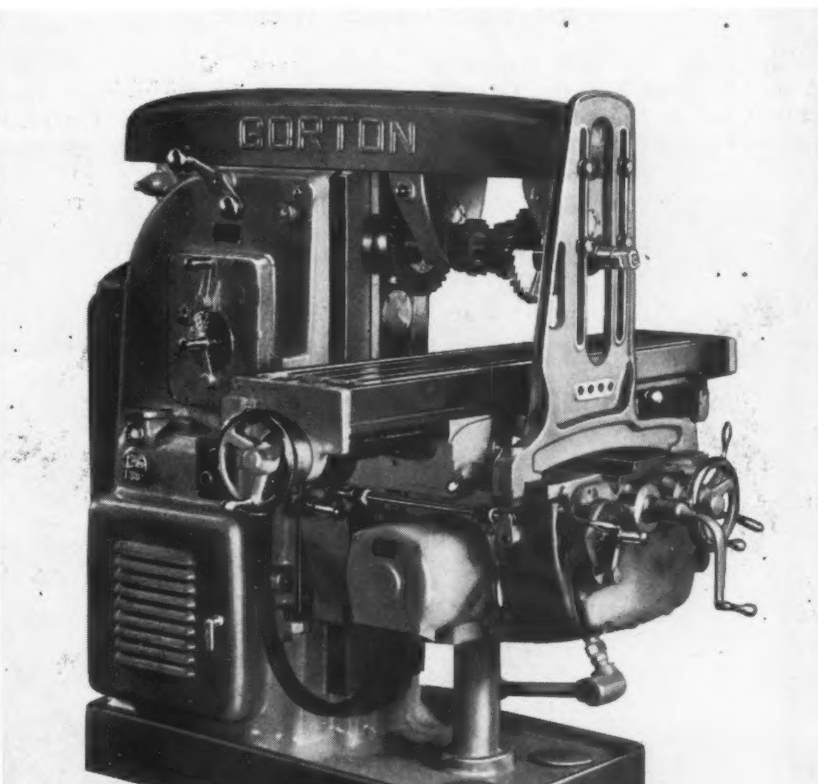
A new No. 2 plain type production milling machine designed to give maximum performance with carbide cutters has just been announced by the George Gorton Machine Co., 1312 Racine St., Racine, Wis. The precision balanced gear-driven spindle of this machine has the two largest gears located close to the spindle nose to provide a smooth running flywheel action with efficient transmission of power from the 10-H.P. driving motor.

An entirely separate 2-H.P. motor is used for the longitudinal, cross, and vertical feeds. The motorized centrifugal coolant pump is directly coupled to the coolant reservoir in the foot of the column, and is driven by a 1/4-H.P. motor. A totally enclosed channel provides a simple, efficient means of returning the coolant from the machine table to the reservoir in the machine base.

The "Fullwidth" knee, securely mounted on the column by a large square lock bearing, is an outstanding feature of this machine, assuring maximum rigidity under the heaviest cutting loads. The massive one-piece column is also designed to combine maximum stiffness and rigidity. The spindle motor is enclosed in the column base.

All controls are fully directional, and are closely grouped at the front of the knee for operating convenience. The controls provide rapid traverse for moving the table, saddle, and knee in longitudinal, cross, and vertical directions with the spindle either idle or running. The self-contained, electrical control cabinet is mounted on the column. The zero speed switch permits instant stopping of the spindle through electrical braking action. All electrical controls are interlocked, so that, if the spindle motor stops for any reason, all machine elements will also stop.

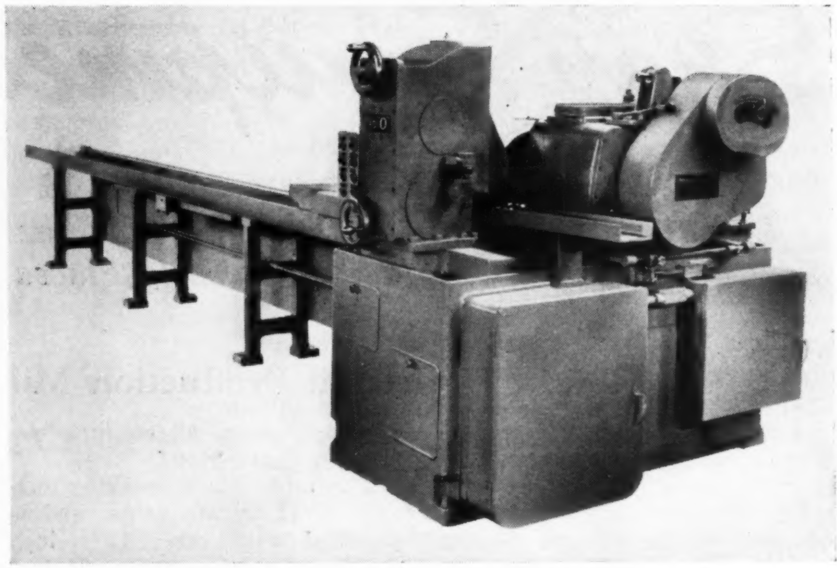
The table has a working surface of 12 by 56 inches, and is provided with three 11/16-inch T-slots. It has a vertical feed of 18 3/4 inches, a longitudinal feed of 28 inches, and a cross-feed of 12 inches. The spindle nose is 5 1/16 inches in diameter, and has a No. 50 National Standard taper, with a through hole 1 1/8 inches in diameter. The eighteen spindle speeds in a 40 to 1 ratio range from 50 to 2000 R.P.M. in approximate geometric progression. The sixteen feeds are in an 80 to 1 ratio, ranging from 3/4 inch to 60 inches per minute for the longitudinal and cross movements, and from 3/8 inch to 30 inches per minute for the vertical movement. Longitudinal and cross rapid traverse is at the rate of 150 inches per minute, and vertical rapid traverse at the rate of 75 inches per minute. The machine is approximately 63 1/2 inches high, 68 inches wide with the table in its central position, about 75 inches deep, front to back, and weighs 5695 pounds. 61



Horizontal Production Milling Machine Brought out by the George Gorton Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 232.

Motch & Merryweather Circular Sawing Machine



Motch & Merryweather Circular Sawing Machine with Automatic Bar Feed

A No. 0-H circular sawing machine with a capacity for handling either round or square stock in sizes up to 4 inches and metal shapes up to 4 by 7 inches has been added to the line of sawing machines built by the Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio. Micrometer adjustment for cutting off stock to exact lengths within very close limits, with either automatic or manual bar feed, is provided. A single hydraulic pump supplies pressure for automatic stock feed, stock clamping, and headstock feed. Hydraulic control protects the tools.

The maximum diameter of saw blade is 18 inches. The two speed ranges available with a 16-inch diameter saw are 30 to 120 surface feet per minute and 1000 to 4000 surface feet per minute. Hydraulic feeds range from 0 to 20 inches per minute. The machine weighs approximately 4900 pounds. The standard automatic bar feed stroke is 36 inches, and the maximum automatic bar feed stroke is 72 inches. 62

Giant-Size Electric Resistance Rotating Type Transformer Welder

The Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio, recently built what is believed to be the largest rotating transformer, single-phase, alternating-current welder unit in the world. This welder is designed for the electric resistance welding of line pipes and oil-well casings of the quality required to meet the specifications of the American Petroleum Institute. It has a capacity for welding pipe from 4 1/2 to 16 inches outside diameter, with a wall thickness of 1/2 inch. Operating speeds range from 15 to 60 feet per minute, 16-inch pipe with 1/2-inch walls being handled at the rate of 20 feet per minute.

The welder transformer has a 1500-KVA capacity with a 440-

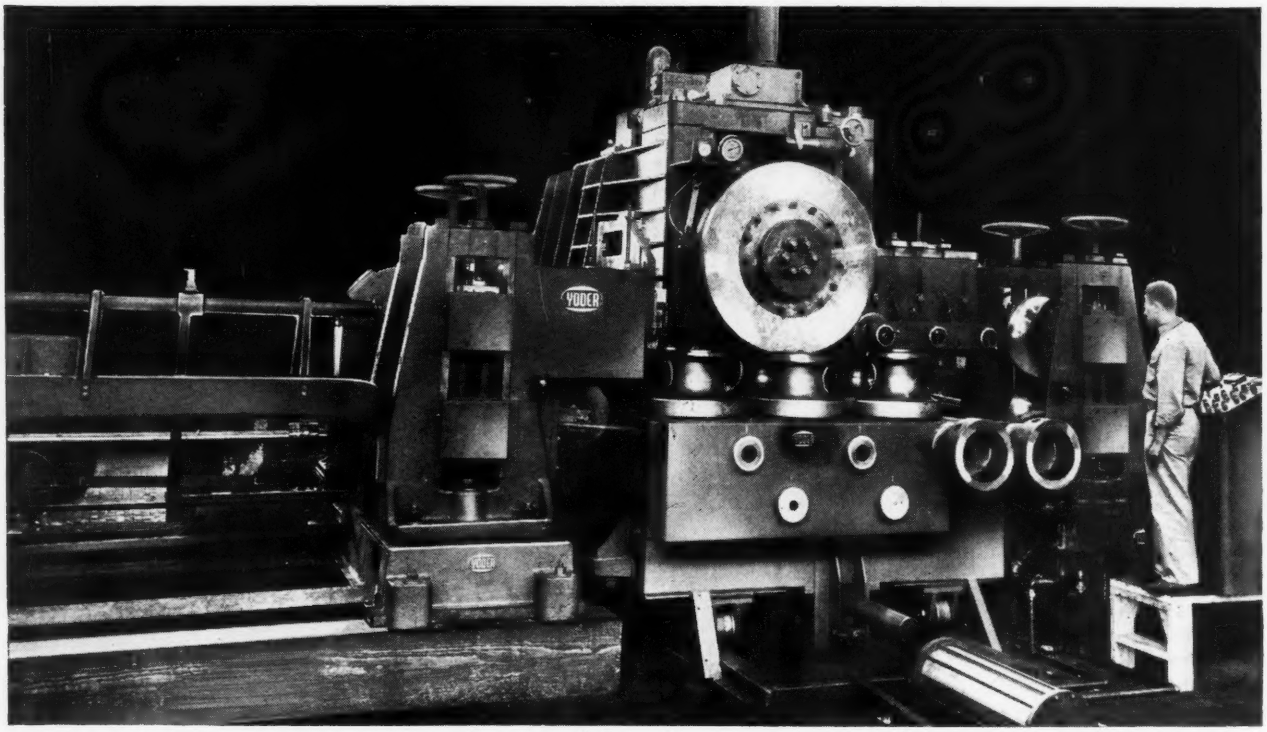


Fig. 1. Yoder Giant-size Electric Resistance Welding Machine of the Rotating Type Used in Welding Large Pipe

To obtain additional information on equipment described on this page, see lower part of page 232.

volt, 60-cycle, single-phase input and an output of 10 volts at 150,000 amperes. Single-phase power is derived from a 1500-KVA motor-generator set driven by a 1750-H.P. synchronous motor.

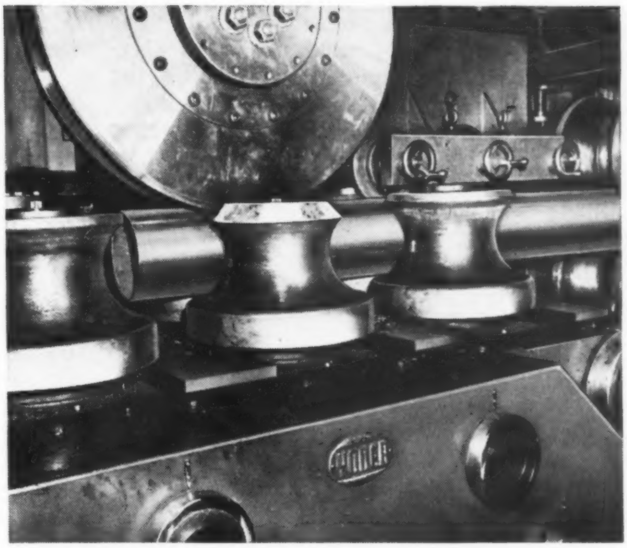


Fig. 2. Close-up View of Rolls on Machine Illustrated in Fig. 1, with a Large Pipe in Position for Welding

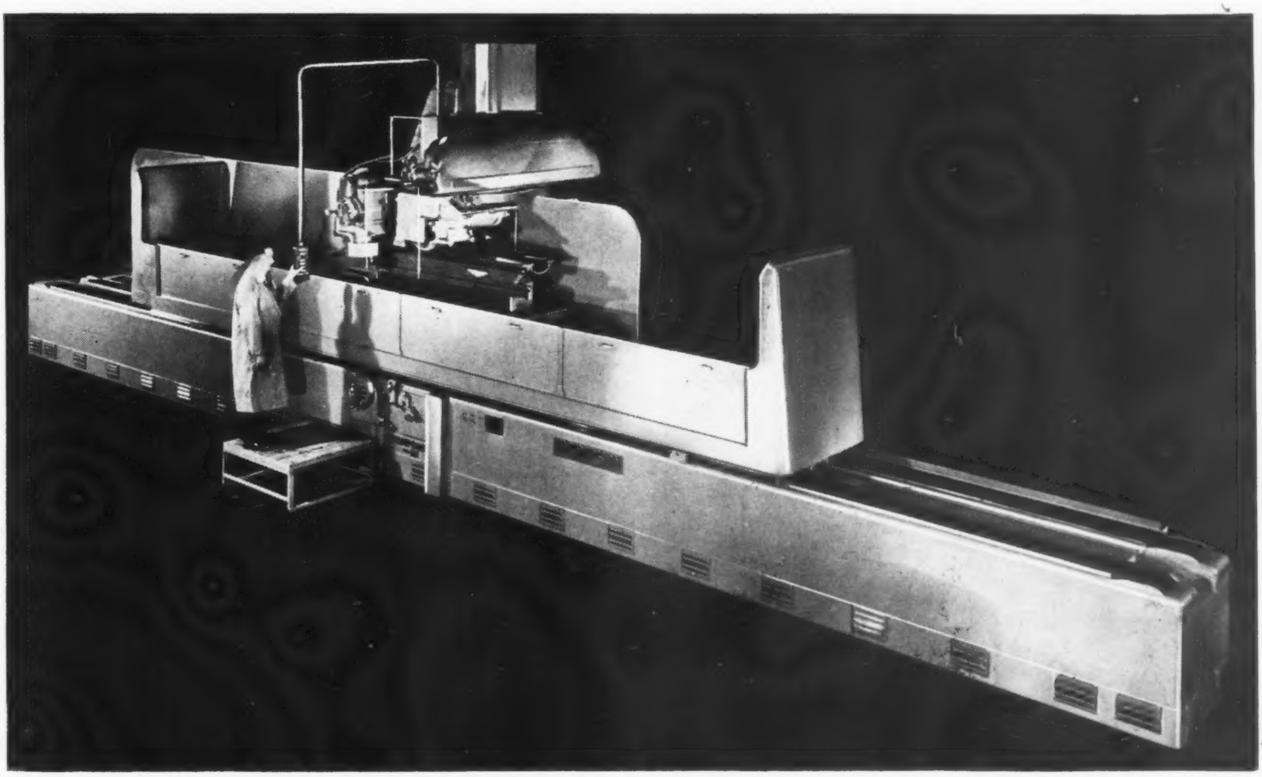
The complete welder unit weighs over 180,000 pounds. The electrodes, which are 54 inches in diameter by 3 15/16 inches thick, weigh 2000 pounds per pair. The welder transformer weighs approximately 6000 pounds. In order to facilitate rapid changing of rolls, the entire squeeze roll base is mounted on wheels and is arranged with an air cylinder to enable the operator to withdraw the base from under the welder when changing rolls. The squeeze or welding rolls are motor-driven to insure a positive drive and steady flow of material under the electrodes. The adjustments of the squeeze and holding rolls are also motor-driven.

Provision is made for quickly dressing the electrodes and for changing the contour within the pipe size range of the electrodes. The amount of electrode pressure is measured on the dial of a "Statimeter," permanently mounted on the unit. Carbide-tipped scarfing tools remove "flash" or upset metal at the point of the weld, both on the inside and outside of the pipe. A tachometer permits setting the speed of the electrode to suit requirements...63

Thompson Heavy-Duty Hydraulic Way Grinder

A massive, heavy-duty hydraulic way grinder has been added to the line of surface grinders manufactured by the Thompson Grinder Co., Springfield, Ohio. This 30- by 48- by 196-inch machine is known as the CX way grinder. The model illustrated has a bed 46 feet long. This grinder is equipped with an auxiliary vertical spindle for grinding the safety gib, clamp surfaces, and rack seats on lathe beds. The lathe bed ways are ground with the horizontal spindle, using a grinding wheel which is trued to the proper angle for the vees and flats.

This machine is easily operated, two levers controlling the entire hydraulic movement of the table and wheel-head units. An antifrction elevating nut permits feeding the wheel-head within limits of 0.0001 inch. Controls are grouped at the normal position of



Thompson Heavy-duty Hydraulic Grinder Set up for Grinding the Ways of a Lathe

To obtain additional information on equipment described on this page, see lower part of page 232.

the operator, and are hydraulically balanced for finger-tip control. The table speeds and wheel-head feeds are hydraulically operated, the table speeds being variable from 10 to 100 feet per minute by a single lever control. An automatic feed to the wheel-head, which acts at each reversal of the table, is easily adjustable. Hydraulic rapid traverse is at the rate of 240 inches per minute, and the hydraulic wheel-truing traverse is 6 inches per minute. The wheel-head unit is driven by a 30-H.P. motor. 64

H-P-M Fast-Traverse Single-Action Press

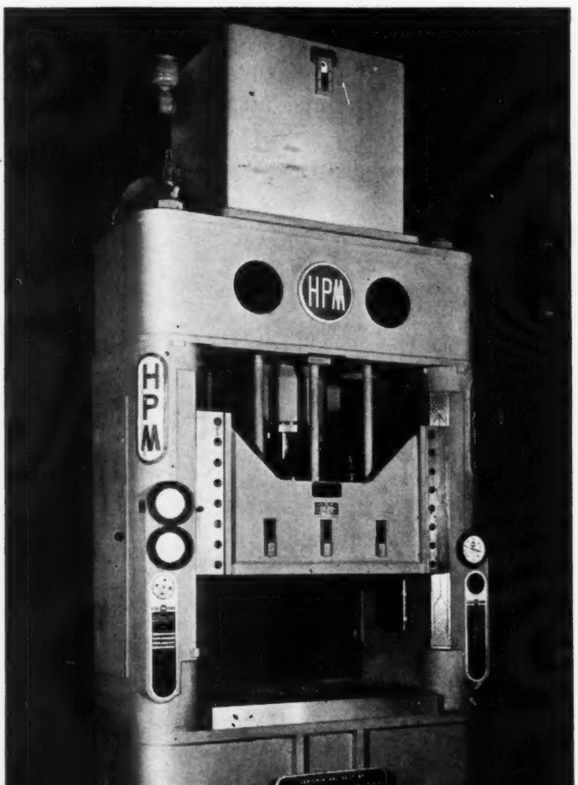
A 100-ton fast-traverse single-action press adapted for the rapid deep-drawing and forming of sheet metal has recently been built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. The new press is an all-hydraulic, self-contained unit with a 48- by 36-inch platen, 30-inch daylight space, and 18-inch main ram travel capacity. A 33-ton hydraulic die cushion with a 32- by 25-inch platen and a 7-inch stroke is located in the bed of the press.

The hydraulic cylinder, with power ram which actuates the main slide, is incorporated in the press head. Three mechanical knock-outs are built into the main slide. The press closes and opens at the rate of 770 inches per minute, and automatically reverses at a predetermined setting, the speed being slowed down prior to die contact. It will perform approximately twenty cycles per minute, operating on a 12-inch working stroke and building up 100 tons pressure. The pressing speed under full load is 146 inches per minute. Maximum pressure can be obtained at any point within the limits of the stroke. Speed and pressure are easily adjusted.

This press is equipped with a 40-H.P. electric motor directly connected to an H-P-M radial piston type pump. Oil is used as the hydraulic pressure medium. Only one hydraulic pump is required for operating the press slide and die cushion. Three methods of operation are provided—manual, semi-automatic or full automatic Change-over from one method to another can be quickly effected by the operator at the electric control station. 65

Cross Machine for Drilling, Countersinking. and Reaming Flanges of Rear-Axle Shafts

The Cross Company, Detroit 7, Mich., has just completed a special machine designed to drill, countersink, and ream five holes in the flanges of automobile rear-axle shafts at the rate of 225 pieces an hour. This machine has a four-station, power-operated in-



Fast-traverse Single-action Hydraulic Press Built by Hydraulic Press Mfg. Co.

Cross Machine for Drilling, Countersinking, and Reaming Flanges of Rear-axle Shafts

To obtain additional information on equipment described on this page, see lower part of page 232.

dexing table with an independent loading station. It performs a drilling operation on the flange at Station 1, countersinks the drilled holes at Station 2, and reams the holes at Station 3. Two pieces are handled at each station. Independent floating work-holding fixtures are used to insure concentricity between holes and pilot diameter. Flexibility to accommodate changes in product design is provided through the use of a standard Cross column and index-table. Feed and rapid traverse are hydraulically operated. The automatic work cycle is controlled by push-buttons. 66

Tilting-Head Hydraulic Molding Press

Emmett Machine & Manufacturing, Inc., 2249-8 Fourteenth St., Akron 14, Ohio, has announced a new "Merit" line of precision-built, tilting-head, hydraulic molding presses. The Model E-113 press illustrated is available in two sizes having platens of 14 by 14 inches or 24 by 24 inches.

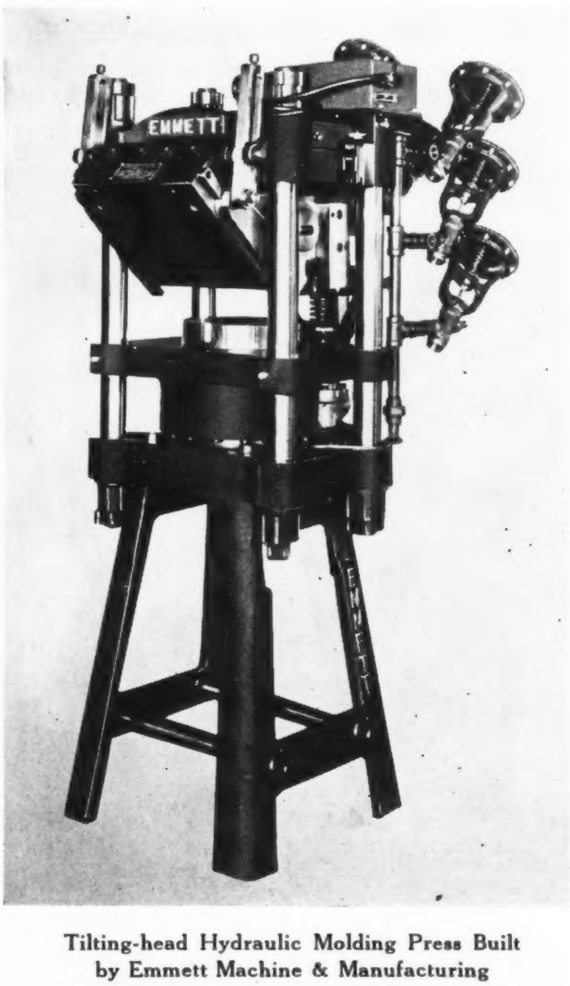
The presses of the new line are designed for applications requiring high-speed operation, accuracy of mold register, convenience of loading, and easy stripping of the molded products from the dies. Heated platens can be supplied if desired.

The operating speed is 3 seconds, including opening or closing of the mold and tilting of the head. The small press has a maximum capacity of 124 tons, and will withstand a maximum stress pressure of 3000 pounds per square inch, while the large press has a maximum capacity of 284 tons and is stressed for a maximum pressure of 2500 pounds per square inch. Pull-back operation is accomplished by means of a telescopic ram located within the main ram. The normal stroke is 2 1/2 or 6 inches on the small size press, and 8 inches on the larger press. 67

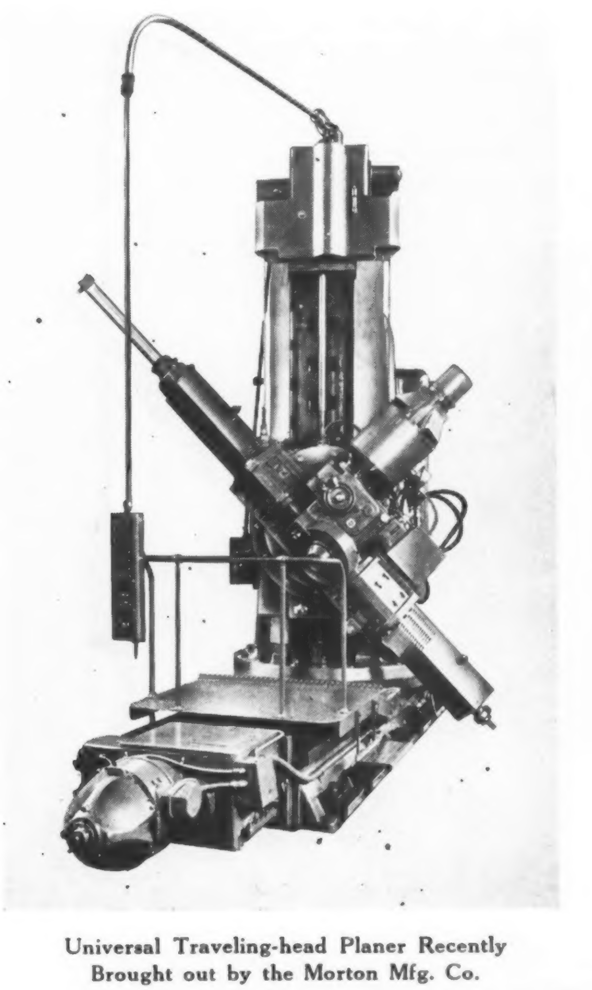
Morton Universal Traveling-Head Planer

A new universal, traveling-head planer arranged especially for shaping, planing, and slotting operations has been announced by the Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. This planer has a maximum cutting stroke of 65 inches, a vertical feed on the column of 48 inches, and a bed approximately 17 feet long with a horizontal travel of 10 feet. The column can be rotated 360 degrees, and the ram is adjustable 25 degrees either way from the horizontal position.

The 9-inch square forged steel ram is designed to provide the rigidity required for heavy-duty operations. The ram has a bearing surface of 60 inches in the saddle. The standard draw-cut shaper head has a hand feed of 6 inches and accommodates 1 1/2- by 2-inch cutting tools. Alternating-current, variable-voltage motors and control equipment are provided. 68



Tilting-head Hydraulic Molding Press Built by Emmett Machine & Manufacturing

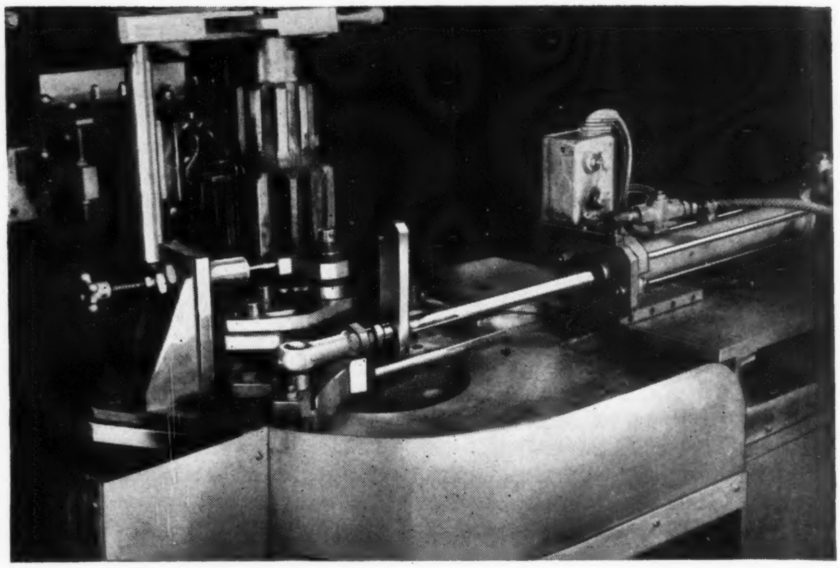


Universal Traveling-head Planer Recently Brought out by the Morton Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 232.

Automatic Gear-Hardening Machine

A completely automatic heating, quenching, and indexing machine for hardening gear teeth one at a time by employing induction heating has been developed by the Induction Heating Corporation, 181 Wythe Ave., Brooklyn 11, N. Y. The handling operation involves only the insertion and removal of the work. Gears that, because of their size, would require very large equipment for hardening in one operation can now be hardened with 20-K.W. equipment on this machine. Because of its unusual design, gears 20 inches in diameter with a 12-inch face and larger, depending upon the generator capacity, are accommodated by this unit. Savings in power consumption and labor make it particularly well adapted for both high- and low-production requirements. 69



Automatic Gear-hardening Machine Developed by the Induction Heating Corporation

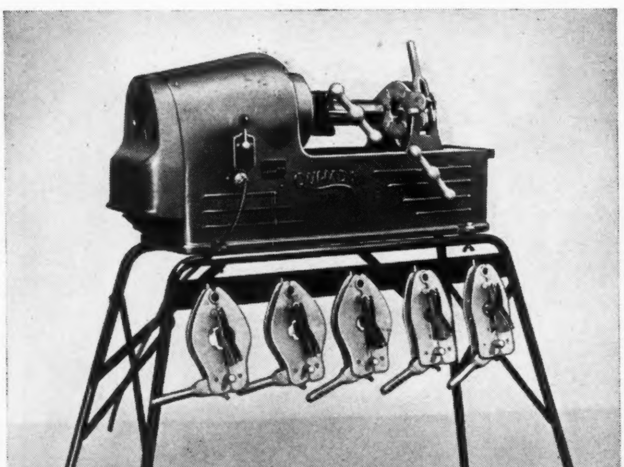
Quijada Pipe-Threading Machine

A new Model 3A pipe-threading machine designed for rapid, easy operation has been brought out by the Quijada Tool Co., Inc., 5474 Alhambra Ave., Los Angeles 32, Calif. Simply operating a switch causes the automatic chuck of the machine to instantly grip and center the pipe for the threading operation.

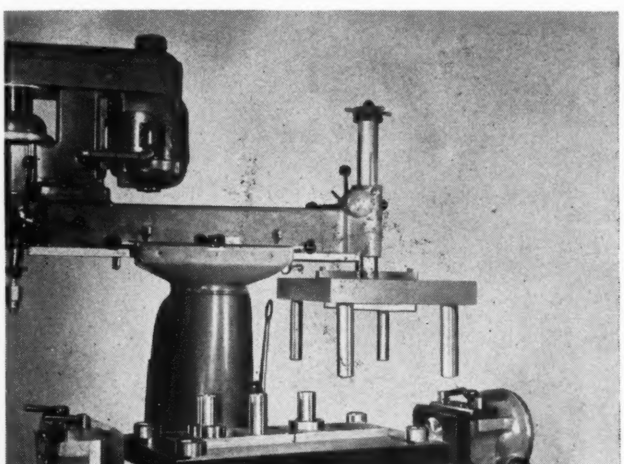
This machine is supplied with six quick-opening die-heads, covering a range of 1/2 inch to 2 inches. Each head has its own high-speed dies. All dies in each head can be adjusted simultaneously for changing the depth of thread by turning a single adjusting screw. Each head is equipped with a burring tool, which reams the pipe as the head performs the threading operation. The heavy-duty 1/2-H.P. motor operates on a 115-volt line of any cycle. 70

Moore "Die Flipper" of Improved Design

An improved type of "Die Flipper," has been announced by the Moore Special Tool Co., Inc., Bridgeport, Conn. With the new "Die Flipper," a die set 20 by 40



Quijada Pipe-threading Machine Equipped with an Automatic Quick-action Chuck



Moore "Die Flipper" with Rear Lifting Device Shown Removing an Entire Die Bed

To obtain additional information on equipment described on this page, see lower part of page 232.

inches with a 12-inch shut height can be taken apart and turned over. This equipment enables a diemaker to drill, tap, and try out the punch-holder and die-shoe while they are securely clamped to the machine.

Among the new features are a rear lifting device located on the arm of the radial drill on the opposite side of the column from the drill spindle. This device makes possible the mechanical removal of the entire die bed or punch-holder and, if desirable, the placing of either member on a rolling truck while work is being performed on the other.

With the new "Die Flipper" it is also possible to counterbore for screw-heads in the punch flange. A 3/4-inch drill chuck with a long shank is now available for this work. All four surfaces of the die set can be presented to the drill or tapping device. The capacity of the radial drill has been increased from 1 1/4 to 1 1/2 inches, and provision has been made for obtaining speeds of 200 to 1200 R.P.M.

Also added to the equipment is a set of ten tap-holders ranging in size from 3/16 to 3/4 inch and three tap spindles with lengths of 4, 6, and 12 inches. An 18- by 36- by 36-inch portable steel table is now furnished as standard equipment for storage of the "Die Flipper" accessories. 71

Brown & Sharpe "Electralign" for Aligning Swivel Tables on Grinding Machines

Setting the swivel table of a grinding machine to grind a straight shaft or a shaft with a specified taper can be quickly accomplished by a simple adjustment with the "Electralign" instrument applied as shown in Fig. 1. This instrument, recently brought out by the Brown & Sharpe Mfg. Co., Providence 1, R. I., eliminates the cut-and-try methods usually employed for setting swivel tables.

The "Electralign" provides electronic adjustment without regard to the condition of the table pivot, table wear, weight of work-piece, and location of headstock and footstock on the table. The "Electralign" is used to locate a strain-gage measuring head at each end of the sliding table, which measures the movements of the ends of the swivel table. By making measurements with strain gages, high sensitivity is obtained, displacements of 0.0001 inch being easily detected, which are amplified on an indicating scale. As the amplifier has a scale which is set for the work length, deflections are direct-reading.

In using this equipment, the operator makes a trial grind, and then measures the work to determine the amount of error in taper. Next he sets the amplifier selector knob to the axial length reading for which he has just made his taper measurement, and brings the measuring head spindles at each end of the taper in pressure contact with the swivel-table anvils. A knurled adjusting screw, located on the front of the right-hand measuring head, is then turned until the amplifier meter pointer reads to as many ten-thousandths inch off zero as the work was off taper. When the swivel table is moved, through its regular adjusting mechanism, enough to make the meter pointer read zero, the error in taper has been corrected. This correction can be made during the grinding operation.

When it is desired to make external or internal measurements employing a comparator in conjunction with the operation of aligning the table, the "Electralign" can be supplemented by the "Electralign-Comparator" selector, shown in Fig. 2. 72

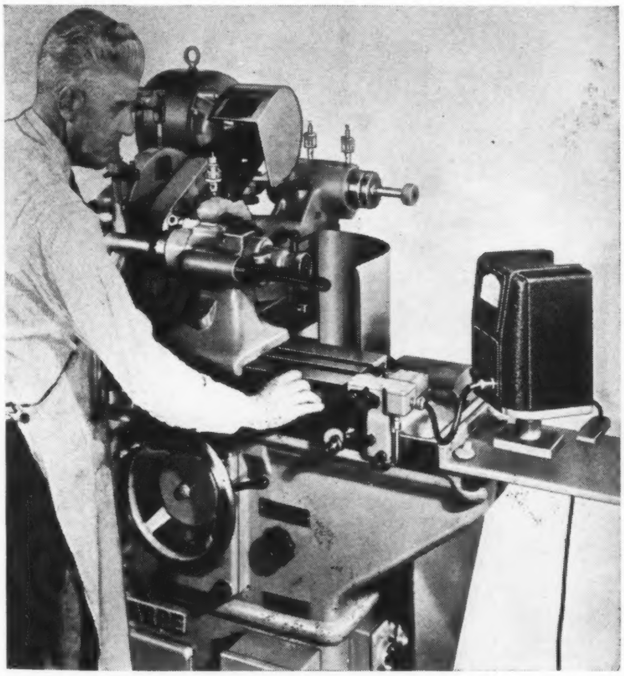


Fig. 1. Brown & Sharpe "Electralign" Instrument Employed in Setting Swivel Table of Grinding Machine

Fig. 2. "Electralign" Instrument with Comparator Selector for Making External or Internal Measurements

To obtain additional information on equipment described on this page, see lower part of page 232.

B & T High-Speed Unit Die-Casting Machine

A die-casting machine of radically new design with a rated production capacity of 500 shots per hour, but which has been operated at a speed of 720 shots per hour, has been announced by the B & T Engineering & Sales Co., 2268 Penobscot Bldg., Detroit 26, Mich. One of the important features is the arrangement of the fixed and traveling machine plates which enables them to directly receive die inserts in their abutting faces. Thus, four unit dies, each a complete die 8 inches in diameter, can be made an integral part of the machine plates. Each of these dies can be changed and other dies substituted as production requires.

The machine is equipped for rapid cooling and automatic ejection. Two of the unit dies are arranged for side core pulls, and are actuated by cams through the opening movement of the traveling die platen, or they can be operated by hand or hydraulically.

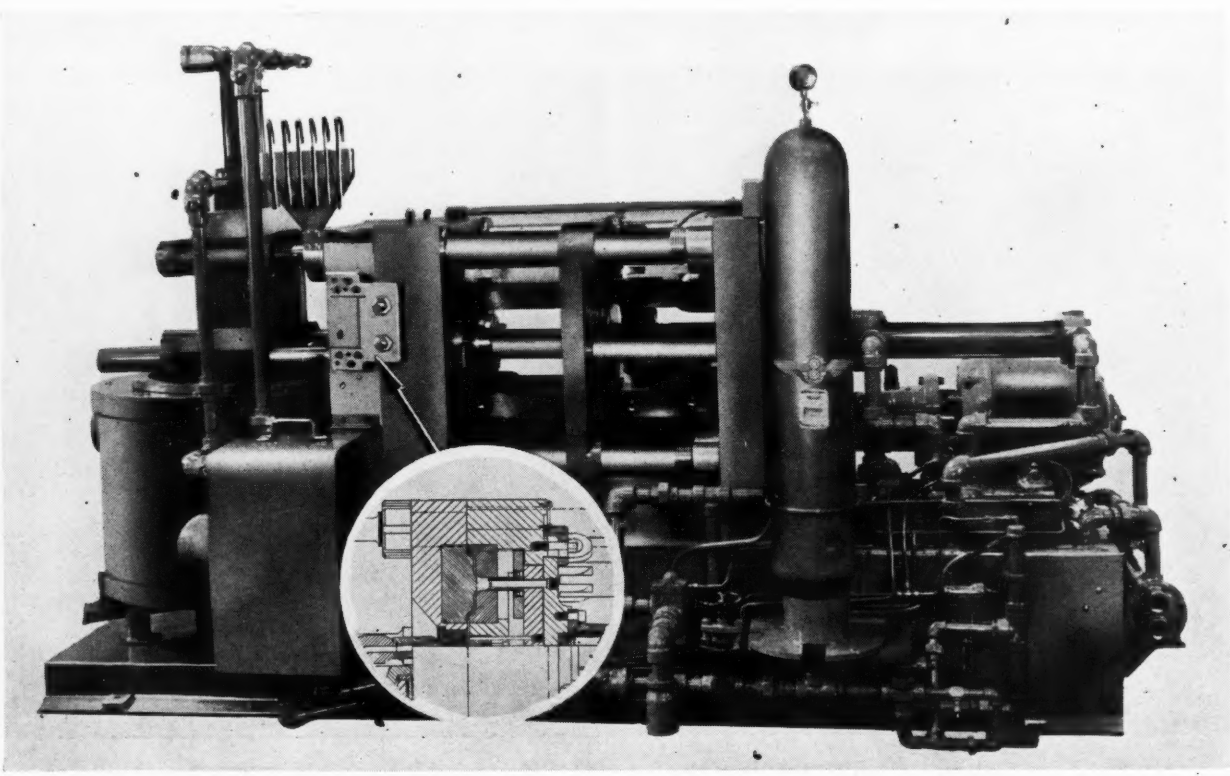
The new machine has four toggles, which means that there are twice as many knuckles or forks, and consequently, twice the number of shear areas on the pins, thus reducing shear load per pin, as well as halving the bending moment on the pins. These toggles exert a locking pressure of 450 tons, insuring safety and accurate production within the entire range of operations, which displaces from 3 pounds of metal per shot under a plunger pressure of 4000 pounds per square inch to 16 pounds of metal under a pressure of 1000 pounds per square inch.

Another B & T engineering development of importance to the die-casting industry is a new type of milling fixture that acts also as a drill jig and that was designed especially for the new B & T Model 300 die-casting machine. This fixture holds the work or die-blocks, from the layout through the finish stages. Two recesses are provided which receive round steel die blanks which are to become both the cover half and the ejector half of the unit dies. The round blocks are set flush with the face of the fixture and locked in position. The trued face and outer edges of this fixture give the diemaker a convenient base from which all dimensions can be accurately scribed on the work, so that impressions can be machined in the unit to obtain exact matching...73

Oakite Steam Gun

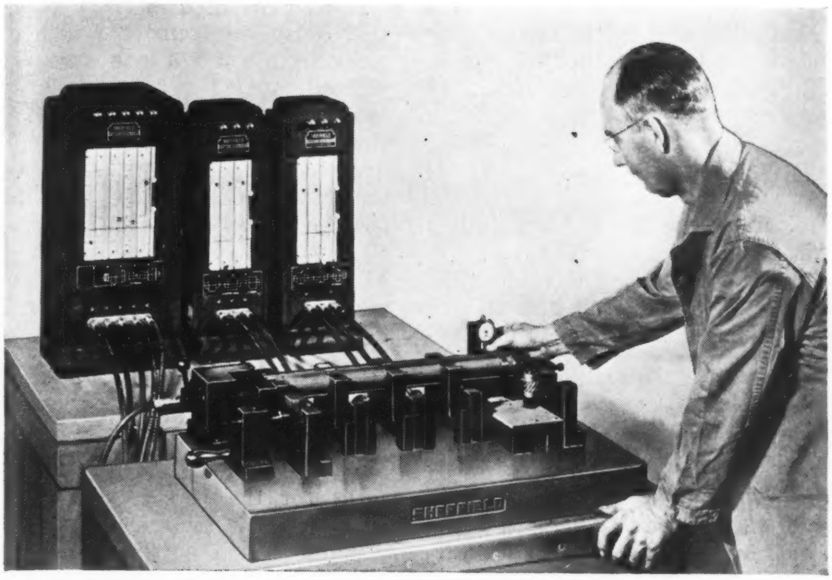
Oakite Products, Inc., 126 Thames St., New York 6, N. Y., have announced the addition of a Model 481 solution-lifting steam gun to the company's line of steam cleaning equipment. This new steam gun is designed to facilitate volume cleaning operations in industrial plants, its easy handling characteristics being an outstanding feature. The gun has an over-all length of 5 feet and is so balanced that it can be used for extended periods without tiring the operator. The two spade type insulated handles are so positioned that each of the operator's hands supports the same weight during a high-pressure steam cleaning operation.

The forward handle of the gun remains stationary in the operator's grasp as the gun is rotated, while the rear handle is easily turned to rotate the gun when cleaning hard-to-reach surfaces. Steam solution hoses are connected to the gun by swivel joints and remain stationary when the gun is rotated. The whole gun turns freely as a unit when the rear handle is moved. A reinforced rubber apron backs up the steam valve and other hot fittings, thus protecting the operator. 74



B & T High-speed Unit Die-Casting Machine

To obtain additional information on equipment described on this page, see lower part of page 232.



Sheffield Precisionaire Gaging Machine Used for Gaging Critical Dimensions of an Automobile Camshaft

Precisionaire Camshaft Gaging Machine

A Precisionaire machine recently developed by the Sheffield Corporation, Dayton 1, Ohio, permits complete and almost simultaneous gaging of most of the critical dimensions of an automobile camshaft. Six bearing diameters and two lengths of the camshaft are checked with "Airsnaps" used in conjunction with a five-column and a three-column Precisionaire base instrument. The shaft is revolved manually for checking out-of-roundness and also for checking the concentricity of five bearings. Gaging of two length dimensions is accomplished by additional air jets.

Run-out of the oil-pump drive gear is checked by a separate gaging unit consisting of a mating gear mounted on a ball slide which accommodates a dial indicator. The relief hole is tested for clear passage by directing a jet of air into the end, the stream of air being felt by the operator when the passage is unrestricted. A Scleroscope is mounted in front of the gaging station to determine the hardness of the camshaft...75

Air-Electric Control for Steelweld Presses

Air-electric control has been made available for all Steelweld presses manufactured by the Cleveland Crane & Engineering Co., 5414 E. 282nd St., Wickliffe, Ohio. With this control, an air cylinder does the work of throwing in the clutch, which is ordinarily performed by a mechanical foot-operated treadle. The air cylinder can be actuated by hand-button, foot-switch, or combinations of both. This control insures safe operation when two or more men work simultaneously on the same press, since it permits the press to function only when all operators are ready.

Fig. 1 shows the air-electric control equipment mounted on the left-hand end of a Steelweld press.

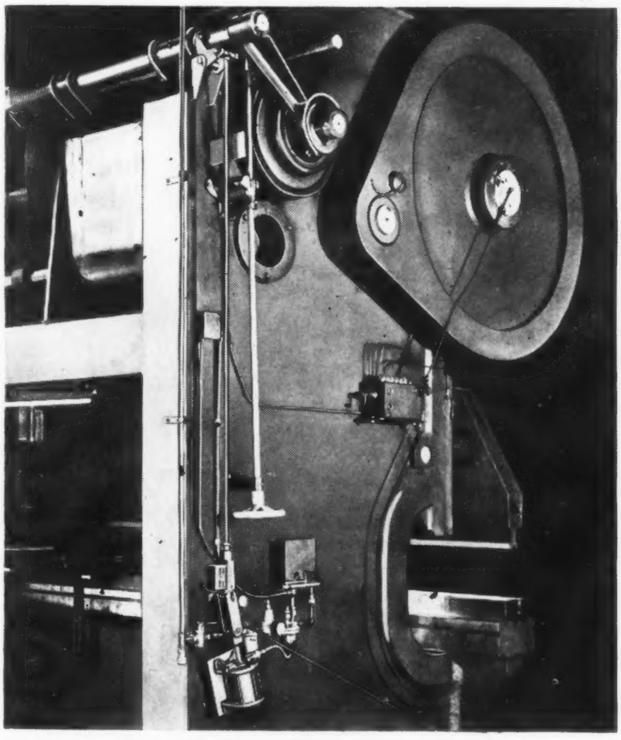


Fig. 1. Air-electric Control Equipment Mounted on Steelweld Press

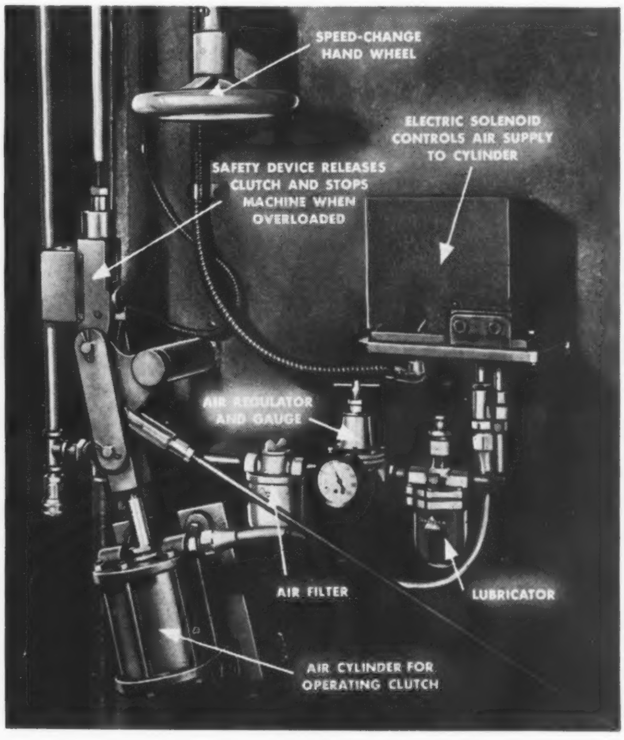


Fig. 2. Close-up View of Parts of Air-electric Control Equipment

To obtain additional information on equipment described on this page, see lower part of page 232.

The clutch and brake are near the top of the machine, and are operated by a common shaft equipped with a heavy spring that normally keeps the brake engaged. This shaft is moved by the air cylinder shown in the close-up view, Fig. 2, through a long vertical rod.......76

Snyder Car-Wheel Boring Machine

A machine designed for rough-boring railroad car wheels and similar large forgings and castings at high production rates has been built recently by the Snyder Tool & Engineering Co., E. Lafayette, Detroit, Mich. This machine was developed especially for use in foundries and steel mills. It has the massiveness and rigidity required to assure maintaining close tolerances over an estimated machine lifetime of twenty years. Operation is fully automatic. While the unit shown is intended for rough-boring steel car wheels at the rate of forty an hour, or cast-iron wheels at the rate of seventy an hour, a similar machine is available for finish-boring any type of large casting or steel forging.

The rough-boring machine has two stations, and is equipped with a hydraulically operated slide that moves the work from the loading to the working station, and then shuttles it to the unloading and reloading positions. Clamping is accomplished hydraulically.

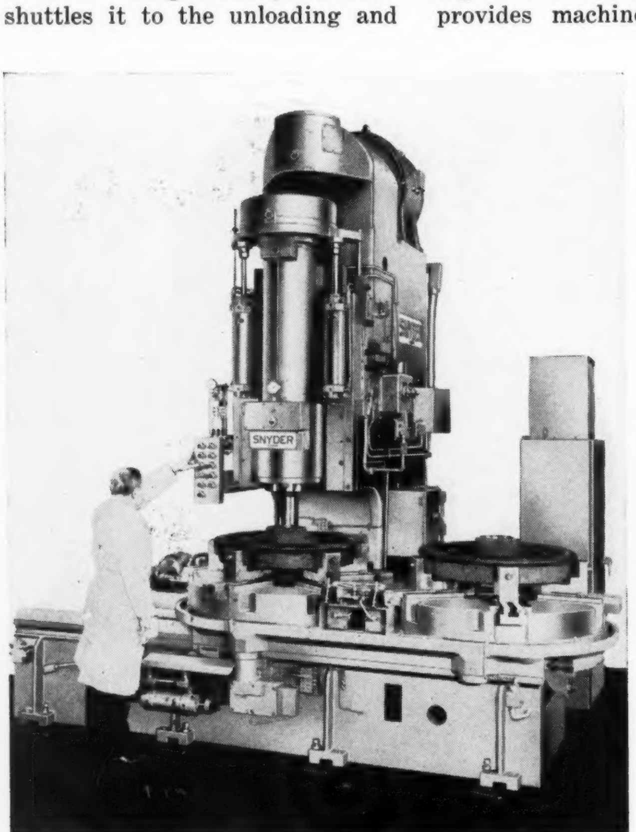
A 75-H.P. motor is coupled directly to the geared and splined drive mechanism. The tungsten-carbide tools used in the application illustrated remove 1 inch of stock from a 5 3/4-inch diameter pierced hole, 7 1/2 inches long, in a steel car wheel. The cutting time for this operation is fifty-five seconds per wheel. Any type tools can be used as required by the work. Tool speeds range from 80 to 240 R.P.M. The stroke is 14 inches. A coolant system with pump can be supplied. Automatic lubrication is provided. 77

Morton Vertical Flash-Trimming Machine and High-Production Trimmer

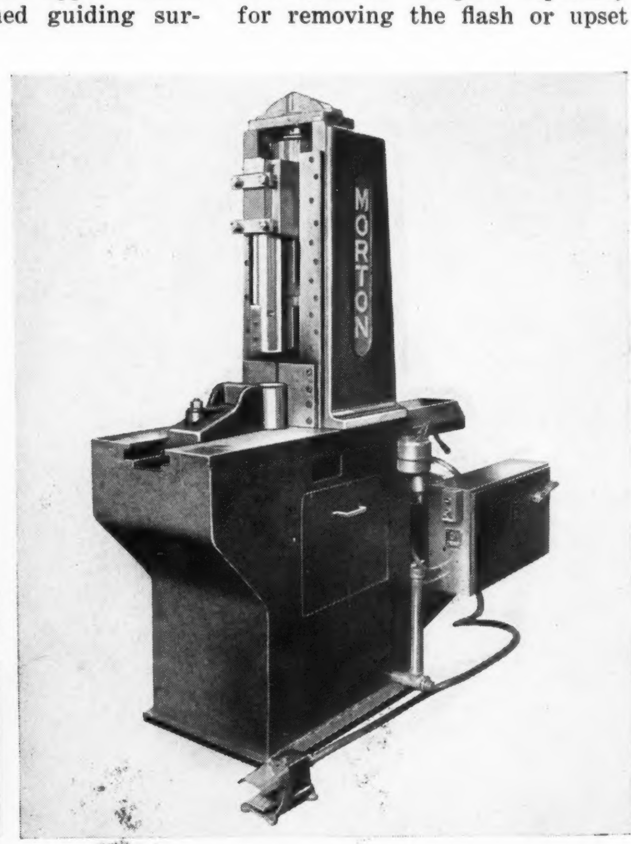
A hydraulically operated machine designed for removing the flash or upset from small butt-welded motor frames and other cylindrical parts has just been announced by the Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. This machine, which is shown in the accompanying illustration, has a capacity of 4 1/2 to 9 inches in diameter, an 8-inch stroke, and will trim stock up to 1/4 inch thick.

The base of the machine contains hydraulic fluid and operating valves, and the upper column provides machined guiding surfaces for the vertically movable cylinder and tool-carriers. The machine has a cutting speed of 50 feet per minute and a return speed of 100 feet per minute. The work-fixture is hydraulically operated, and can be adjusted toward or away from the back clamping dies to take care of any variation in work diameters. The cutting tools are adjustable within the holders, and provision is made for their quick removal for servicing.

The Morton Mfg. Co. has also brought out a new high-production trimmer designed especially for removing the flash or upset



Snyder Machine Developed for Rapid Rough-boring of Railroad Car Wheels



Vertical Flash-trimming Machine Brought out by the Morton Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 232.

from strip stock or cylinders, such as barrel bands or bicycle rims in sizes up to 4 inches wide and 3/32 inch thick. This trimmer has a vertical movement of 1 1/2 inches between the dies to facilitate inserting and removing the work. 78

Reed Cylindrical-Die Thread-Rolling Machine

The Reed Rolled Thread Die Co., 237 Chandler St., Worcester 2, Mass., has introduced a new A32 cylindrical-die thread-rolling machine which has a capacity for rolling threads up to 4 inches in diameter. This machine is of the horizontal type, the work blank being supported and positioned horizontally between three synchronously rotating cylindrical dies. The three dies act on the blank simultaneously, holding it rigidly in the rolling position.

The control of work dimensions is accomplished by positive adjustments for diameter, length, and taper. Adjustable scroll rings in the head provide for approximate setting of the dies, while the final sizing of the work is easily accomplished by means of a micrometer adjustment.

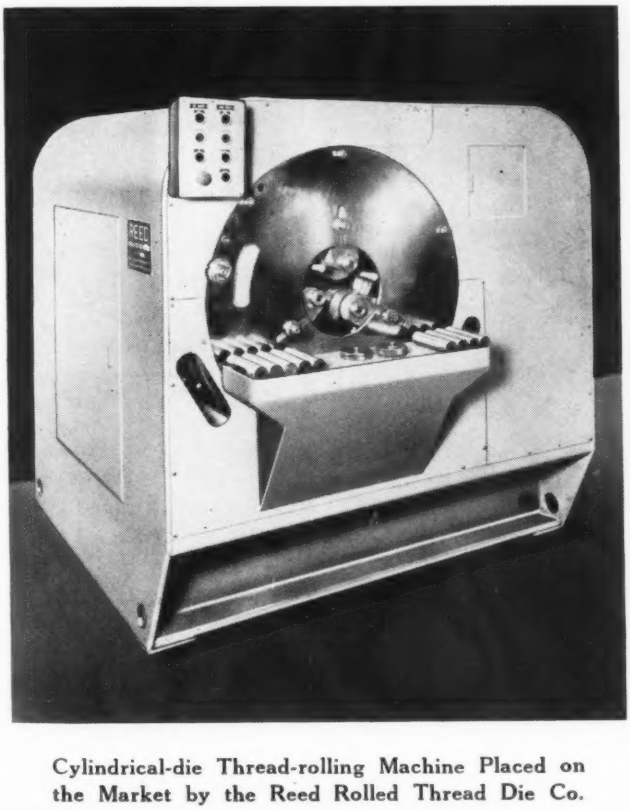
A wide range of die and cam speeds, in conjunction with interchangeable cams, is available for obtaining any desired cycle of squeeze, dwell, and release that may be required for rolling different materials and various thread forms.

The drives for rotating the dies and the control for the feed are operated by individual motors. Separate jogging push-button controls for both die rotation and feed facilitate setting-up and operation of the machine. Either manual or semi-automatic feed, with continuous or single rolling cycles, can be employed. The machine can also be arranged for through feed rolling of continuous threads.

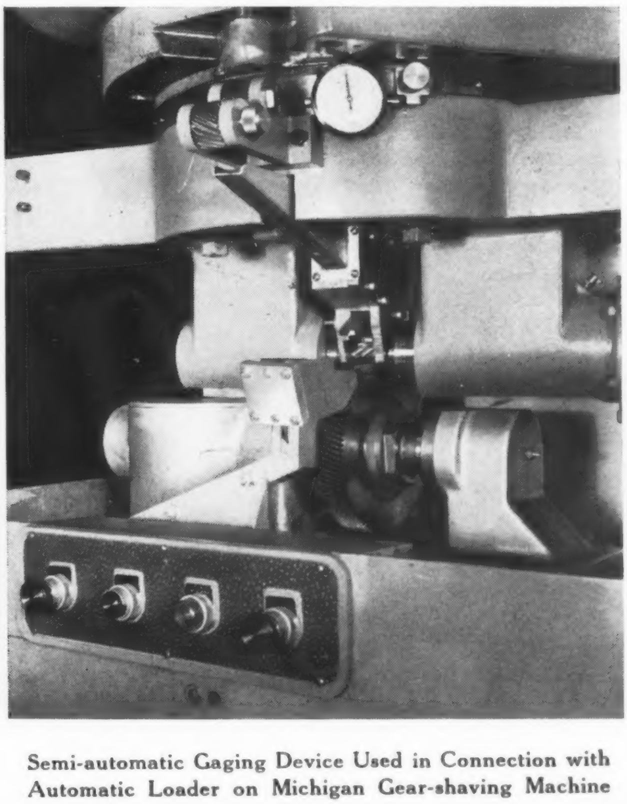
The thread-rolling capacity is from 5/8 inch to 4 inches in diameter. Standard die speeds vary from 115 to 640 R.P.M. The regular work cycles range from 2 to 26 per minute. A 25- to 30-H.P. motor drives the die, and a 3/4- to 1-H.P. motor drives the cam. The built-in coolant tank holds 55 gallons, and is equipped with a motor-driven pump and filtering system. The machine weighs about 11,000 pounds. 79

Michigan Semi-Automatic Gaging and Automatic Loading Equipment

A semi-automatic gaging device and automatic loader for gear-finishing machines has recently been announced by the Michigan Tool Co., 7171 McNichols Road, Detroit, Mich. The gaging device, located at the loading end of the work chute, consists of two gears, arranged to gage the pinions to be finished and so mounted that they can revolve freely. The center distance between the two gaging gears is such that a pinion with an oversize pitch diameter or one on which the stock is excessive for best shaving results will not drop through between the gears into the chute. Pinions dropped into the chute are picked up, one at a time, by automatic adaptors which act as arbors. The picked-up gears are shaved and ejected automatically. The illustration shows one of the pinions in the shaving position, the guard having been removed from the underpass shaver to show the mechanism...80



Cylindrical-die Thread-rolling Machine Placed on the Market by the Reed Rolled Thread Die Co.



Semi-automatic Gaging Device Used in Connection with Automatic Loader on Michigan Gear-shaving Machine

To obtain additional information on equipment described on this page, see lower part of page 232.

Hauser Precision Jig-Boring Machine

A precision jig-boring machine designed to combine a high degree of accuracy with exceptional output has just been made available in this country by the Hauser Machine Tool Corporation, Manhasset, N. Y., exclusive U. S. representatives of Henri Hauser, Ltd., Bienne, Switzerland. An outstanding feature of this machine is the completely centralized control. From the operating position in front of the machine, all controls are within convenient reach.

The micrometer screws of this machine are made of special steel, and are hardened and high-precision ground. The microscope is manufactured according to the Hauser patented method of three-point suspension, and is independent of the rotating part of the spindle.

The capacity is 14 by 8 inches, with settings reading to 0.0001 inch and accuracy of slide locations held to 0.00015 inch. This machine is especially adapted for production work that does not warrant the building of jigs or fixtures. All operations such as centering, marking out, and checking can be performed with a high degree of accuracy. 81

Wood Special Forming Press

The R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa., has brought out an upward moving type 350-ton "HydroLectric" forming press designed primarily for the forming of special signs. The applied pressure can be adjusted within a range of 85 to 350 tons. The press is supplied with motor-driven pumping unit, control valves, and piping. Pump volume and press speeds are adjustable from zero to maximum.

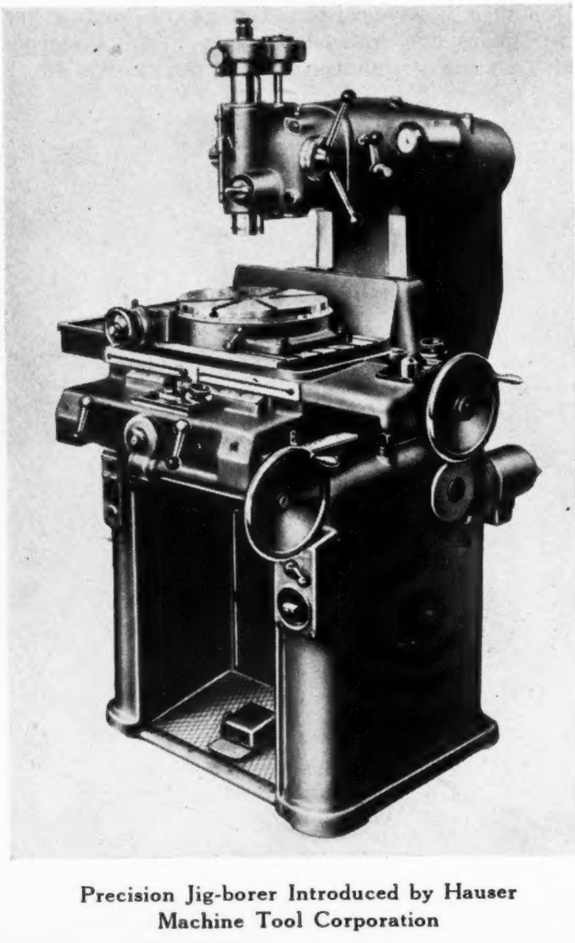
The pumping unit consists essentially of a radial piston pump having a capacity of 14.7 gallons per minute, which is driven by a 15-H.P. electric motor. The press can also be made in other capacities to meet requirements.......82

Haldex Sheet and Plate Cutting Machine

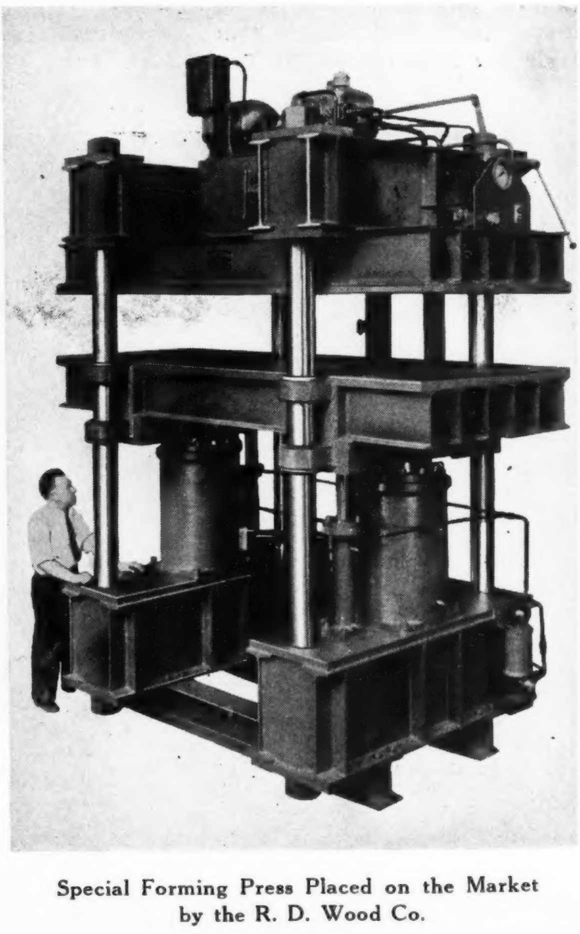
A sheet and plate working machine that performs beading, folding, and straight, circular, or irregular cutting of metal up to 3/8 inch thick has recently been placed on the market. This machine is manufactured by the Haldex Co., of Halmstad, Sweden, and is being distributed in this country by the Pullmax Co., 5222 N. Spaulding Ave., Chicago 25, Ill.

Cutting is accomplished on this machine by two tools, the upper one operating at a very high speed. It is so designed that it does not chip or deform the metal being worked, producing finished edges that are smooth, and require no reworking. The cutting tools do not penetrate the metal, but shear it to the breaking point in such a manner as to produce a smooth cut.

Mild and stainless steel, as well as non-ferrous metals, can be easily cut into intricate designs by unskilled operators after a little practice. A quick-locking

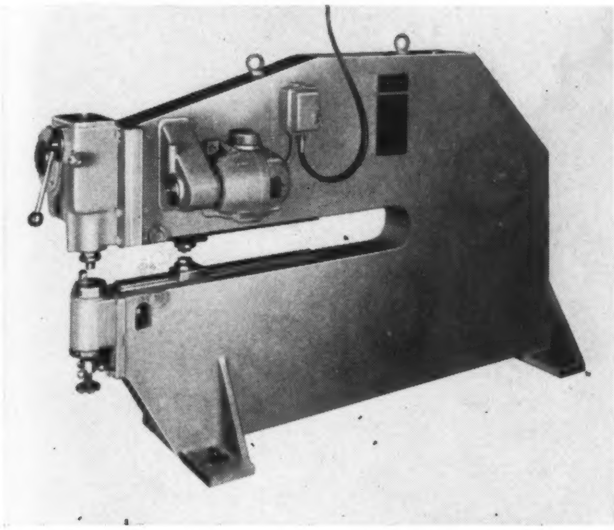


Precision Jig-borer Introduced by Hauser Machine Tool Corporation

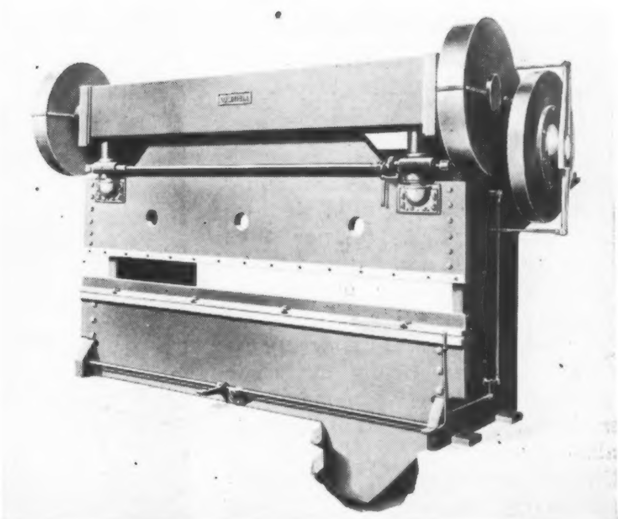


Special Forming Press Placed on the Market by the R. D. Wood Co.

To obtain additional information on equipment described on this page, see lower part of page 232.



Sheet-metal Working Machine Introduced by Pullmax Co.



Columbia Power Press Brake for Forming Mild Steel

centering device permits fast production of circular plates. Various tools can be used for special operations, such as slotting, cutting, nibbling, beading, and folding. This machine is available in seven sizes for working metals of different gages. 83

Lepel High-Frequency Heating Units

A completely redesigned line of high-frequency heating units embodying such improvements as a new frame, base, and panels of all-steel construction has been introduced by Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York City. The new machines in this line are now available in 7 1/2-, 15-, and 30-K.W. rating capacities. The interiors of these units are of the latest fire-resisting materials. Operating controls have been arranged for greater convenience. Other changes include improvements in the spark gap holders which reduce the need for adjustment of spark gaps and the use of special insulation in the high-voltage side of the main transformer.

Without any auxiliary equipment, one of these heating units can be used for hardening, annealing, stress-relieving, brazing, soldering, and melting operations, and it can also be employed with a large variety of work coils for heating parts of different sizes and shapes without requiring matching transformers or condensers. 84

Lepel All-Steel High-frequency Heating Unit

Power Press Brakes

The Columbia Machinery & Engineering Corporation, Hamilton, Ohio, has expanded its line of power press brakes to include a complete range of sizes with capacities ranging from 120 to 900 tons. The new line will form mild steel from 1/8 to 1 inch thick in lengths from 4 to 20 feet. All sizes except the 120-ton model now employ twin-drive main gears. Back-gears in all models operate in oil.

All models have motor-driven slide adjustment with micrometer controls. The slide is easily operated, and can be adjusted out of parallel with the base. Counters at each end indicate the magnitude of adjustment in thousandths of an inch. A wedge type mechanism releases the ram in case the dies jam at the bottom of the stroke.

The centralized lubricating system provides positive lubrication for all main bearings. Special high-torque, high-slip motors can be installed with motor pulley, flywheel, and V-belt drive fully enclosed. Standard bending and forming dies, die-blocks, and tool-holders can be furnished. 85

To obtain additional information on equipment described on this page, see lower part of page 232.

Quickwork-Whiting Stamping Trimmer

The Quickwork-Whiting Division, Whiting Corporation, Harvey, Ill., has announced the development of a light-duty stamping trimmer for cutting mild steel up to 1/16 inch thick. This new 48-L machine is an adaptation of the standard heavy-duty Quickwork-Whiting machine. It is designed for fast, economical trimming or forming of practically any type of stamping. Provision has been made for either constant or variable-speed drive. The drive is through a differential type transmission which permits the use of rolls or cutters of different diameters without variation in the peripheral speed. 86

Wet Cutting System for "Utility" Band Saw

The No. 5 Utility model horizontal metal-cutting band saw built by the Wells Mfg. Corporation, Three Rivers, Mich., is now equipped with a self-contained wet cutting system similar to those used on the Wells Nos. 8 and 12 band saws. Portability of the machine is retained by mounting the chip pan firmly between the bed and base. The complete system includes a fluid tank with centrifugal type pump-motor unit and a screened intake, as well as tubing and a conveniently located flow control valve. All working parts are readily removable.......87

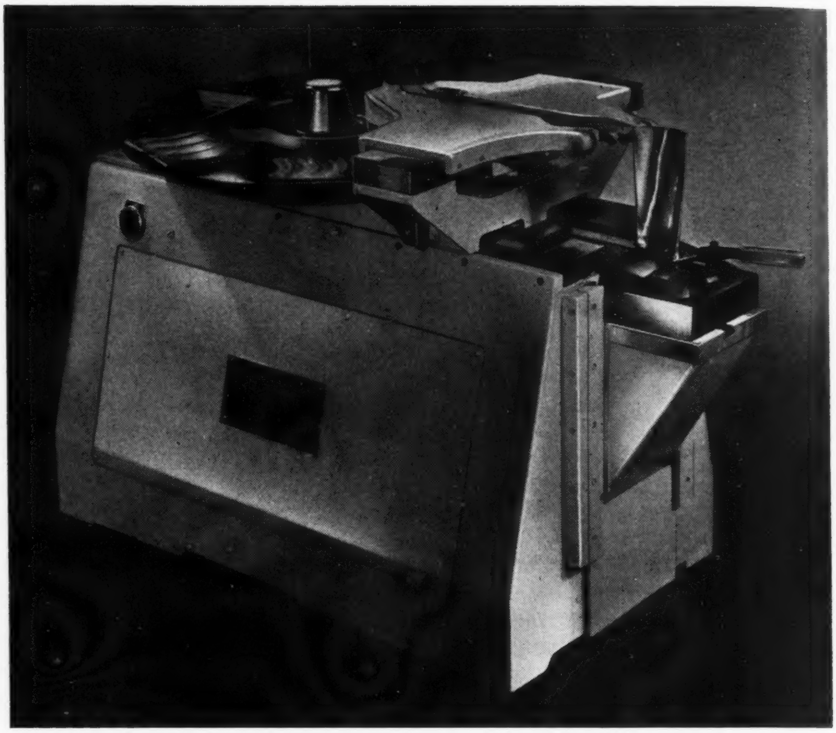
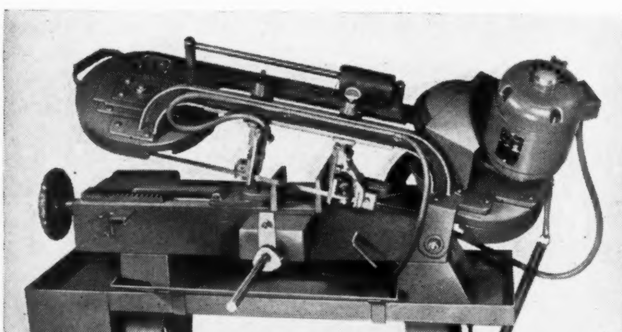


Fig. 1. "Pant-O-Scriber" for Inspecting Turbine Blades for Jet Motors

"Pant-O-Scriber" for Rapid Inspecting of Turbine Blades for Jet Motors

Engineers Specialties Division, Universal Engraving & Colorplate Co., Inc., 980 Ellicott St., Buffalo 8, N. Y., recently developed a device known as the "Pant-O-Scriber" for inspecting air-foil contours on turbine blades and compressor vanes for jet aircraft motors. Since jet motors have from 800 to 1500 blades that may vary from less than 1/2 inch to over 6 inches in length and are of twisted and tapered shapes, this device was designed to inspect a wide range of shapes and sizes.

With the new equipment, a three-section blade can be completely checked for contour, twist, thickness, and other characteristics in less than one minute. A permanent inspection record of each blade is obtained at the time



Wells Utility Metal Cutting Band Saw Equipped with Self-contained Wet Cutting System

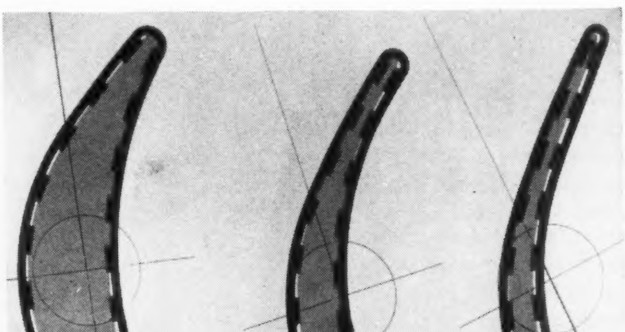


Fig. 2. Bridge Tolerance Chart Developed for Use with "Pant-O-Scriber" Shown in Fig. 1 •

To obtain additional information on equipment described on this page, see lower part of page 232.

of the inspection. The "Pant-O-Scriber" blade-checker automatically traces the blade contour at the sections to be checked (usually three sections), and a co-ordinated rotating scriber produces an accurately scribed outline on a specially coated glass plate.

A precision master inspection chart the actual size of the blade section is used, together with the scribed plate, for inspection purposes. The scribed plate and the inspection chart are placed face to face in a predetermined registered position, and the scribed plate profile and the master inspection chart are projected to any desired size on a white opaque screen, using a standard, vertical lantern-slide projector.

For production inspection purposes, a "Go" and "No Go" bridge tolerance chart, such as shown in Fig. 2, is used. This chart is accurately made to the same size as the blade and section spacings of the blade; the permissible tolerance is shown on the chart as a series of ultimate red and white "bridges," the outside of the bridges being connected by a wide red band. When an acceptable blade is viewed on the projection screen, the operator sees a series of white "windows" created by the contrast between the green scribed blade profile and the red "Go" and "No Go" bridges of the tolerance chart. Three standard models of "Pant-O-Scriber" blade-checkers are available. 88

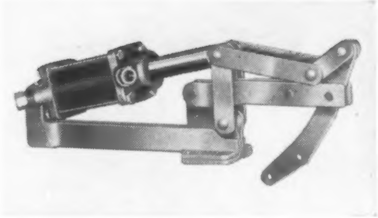


Fig. 1. Knu-Vise Air-operated Clamp Designed to Apply Clamping Pressure "Around Corner"

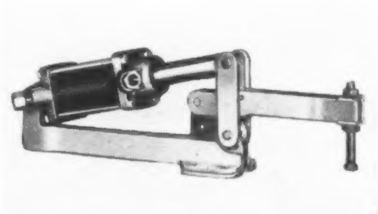


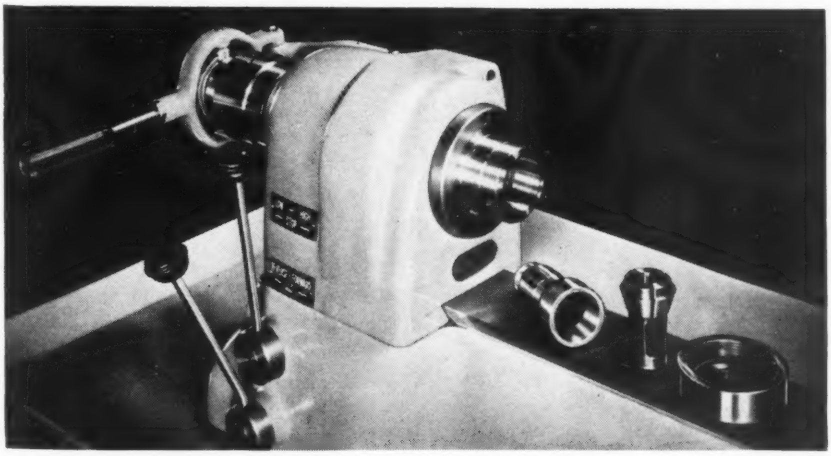
Fig. 2. Knu-Vise Double-acting Air-operated Vise

Hardinge High-Speed Precision Second-Operation Machine

Hardinge Brothers, Inc., Elmira, N. Y., has announced a new model high-speed precision machine with stationary style collet, designed for second-operation work. This machine, known as Model VBS, has all the features of the standard Model DSM59, with the addition of the stationary collet. The collet is particularly designed for use when close tolerances must be maintained on length or shoulder specifications.

The preloaded ball-bearing center-drive headstock spindle has a capacity for handling 1-inch round, 7/8-inch hexagon, and 3/4-inch square stock. Eight spindle speeds are available, either forward or reverse, from 230 to 3500 R.P.M. Three other speed ranges are obtainable for varied production requirements.

Other features include Hardinge precision hardened and ground dovetail bed ways; ball-bearing lever-operated collet closer; constant full-bearing double-tool cross-slide; automatic indexing six-position preloaded ball-bearing turret; self-draining oil-pan with integral sump; and welded steel pedestal base. 89



Hardinge High-speed Precision Machine with Stationary Style Collet Developed for Second-operation Work

Knu-Vise Air-Operated Toggle Clamps

The air-operated toggle clamp shown in Fig. 1 has been added to the line of Knu-Vise products made by the Lapeer Mfg. Co., Lapeer, Mich. This clamp can be used for clamping "around a corner" or for other applications where a clamping support would be inconvenient or would interfere with production. A plier-like grip is produced by the toggle bar, which acts as a supporting member, and the toggle jaw, which does the actual clamping. Both the toggle bar and the toggle jaw swing out to allow removal of the work. The supporting pressure of the toggle bar is 400 pounds at the outer rivet, and the clamping pressure of the toggle jaw is approximately 300 pounds at the inner hole. The operating air pressure is 85 pounds. The clamp will not release work until air pressure is applied to open the clamp jaw.

Over-all dimensions with the clamp closed are length, 13 5/16 inches; height, 4 1/4 inches; with clamp open, height, 7 15/16 inches; and width, 2 1/8 inches.

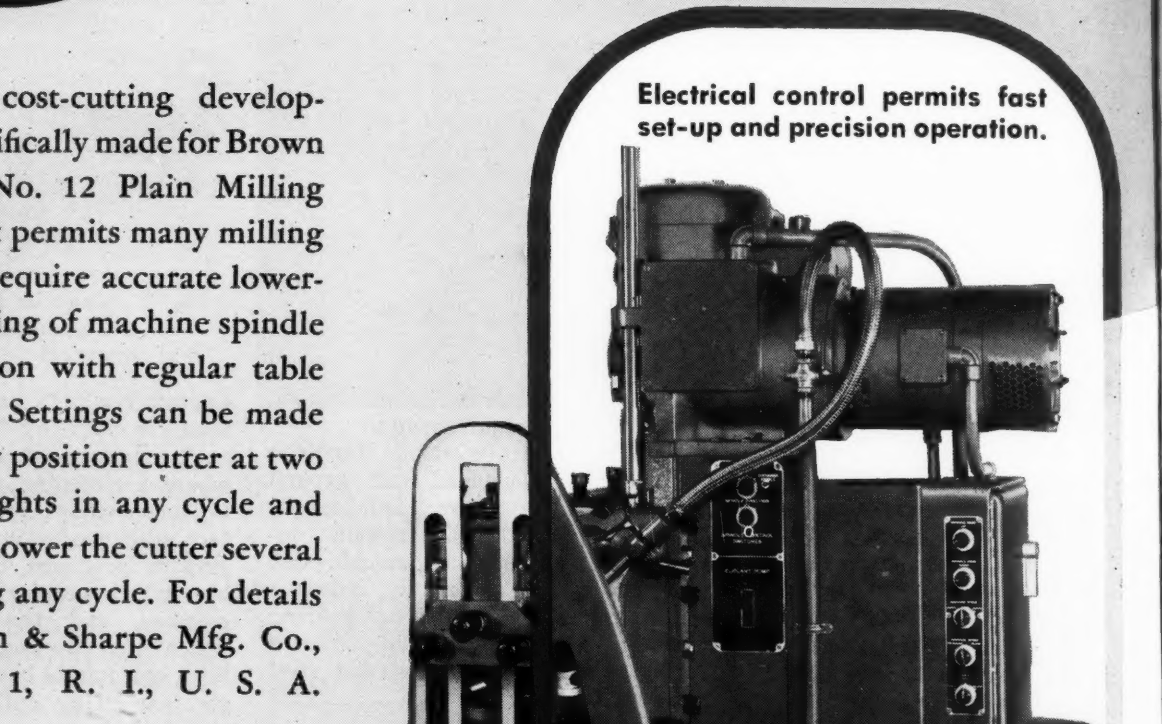
Another recently announced Knu-Vise air-operated clamp is shown in Fig. 2. This clamp is similar in operation to the one shown in Fig. 1, but has a single clamping arm with adjustable screw. The maximum clamping pressure, is 400 pounds, and the air-operating pressure 85 pounds per square inch. Dimensions with clamp open are length, 9 3/8 inches and height, 8 inches; with clamp closed, length, 13 inches and height, 4 inches. Overall width is 2 1/8 inches. 90

To obtain additional information on equipment described on this page, see lower part of page 232.

NOW Spindle Power Feed

FOR NO. 12 PLAIN MILLING MACHINES

THIS NEW cost-cutting development is specifically made for Brown & Sharpe No. 12 Plain Milling Machines. It permits many milling cycles that require accurate lowering and raising of machine spindle in conjunction with regular table movements. Settings can be made to accurately position cutter at two different heights in any cycle and to raise and lower the cutter several times during any cycle. For details write Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



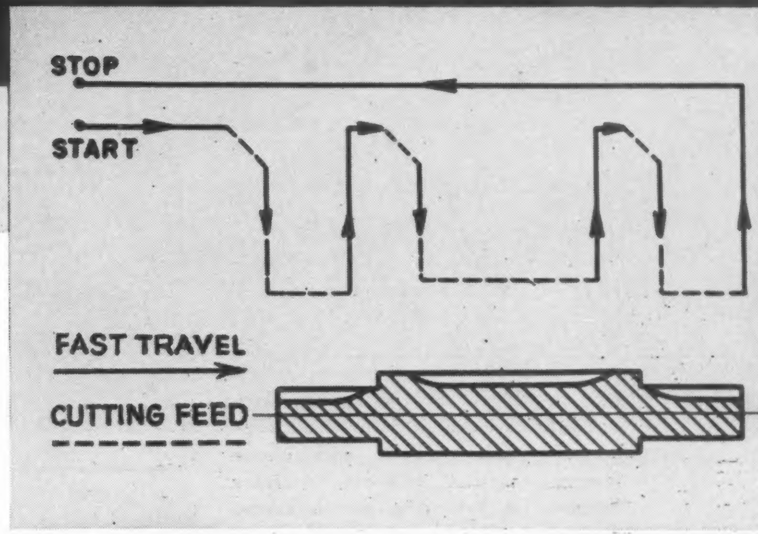
Electrical control permits fast set-up and precision operation.

Wide range of spindle head feeds can be obtained. Pick-off gears for feeds from ½" to 7⅝" per minute are available. Powered by brake-type motor. Rapid travel rate is 30" per minute.

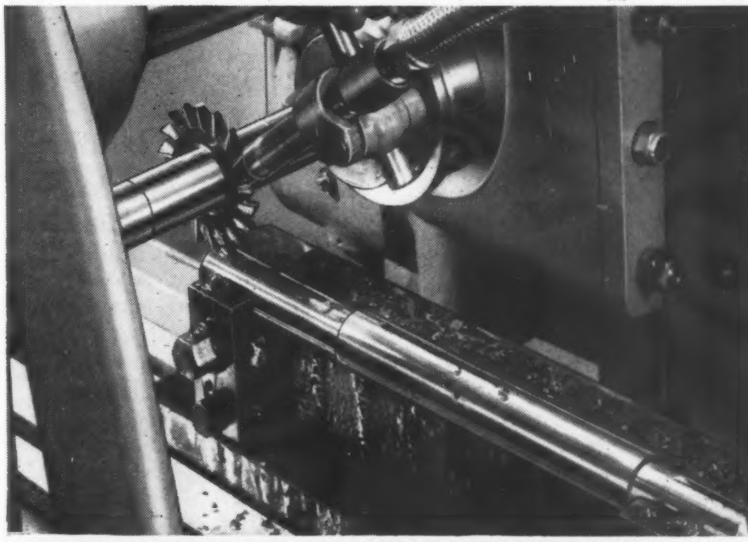
BROWN &

d gives more work, with fewer set-ups

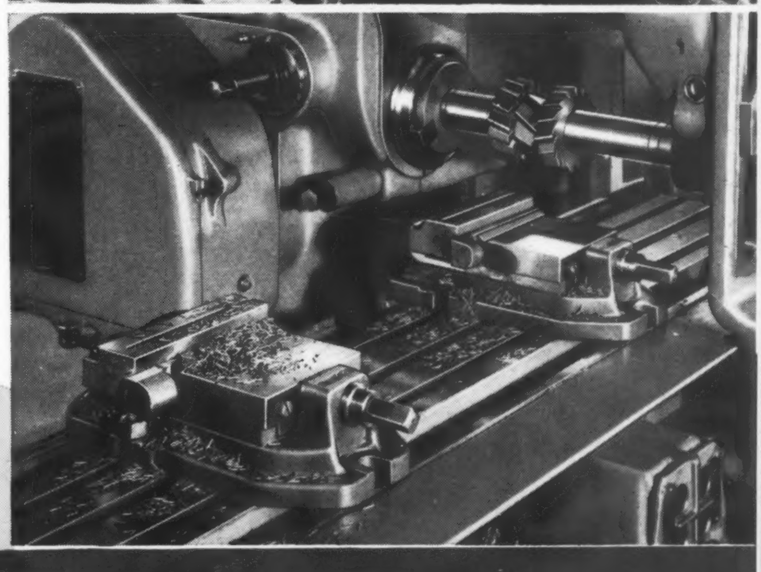
ES



THE DIAGRAM at right shows one of many cycles made available by this new device. Horizontal arrows are for table direction, vertical arrows for spindle head direction, and the type of job is shown beneath the cycle. Cycles can be made with machine table starting in either direction. For information about a cycle that may simplify your milling, consult our Milling Engineering Service.



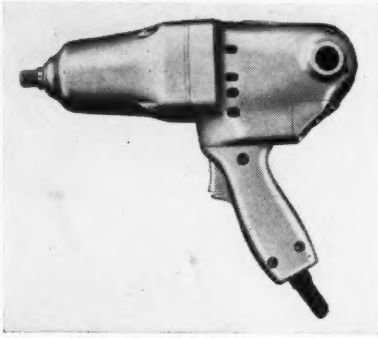
MILLING THREE KEYWAYS, as shown at the right, requires that the cutter operate at two different heights above the machine table. This operation is done automatically with the Spindle Power Feed Mechanism using cycle shown above.



CLIMB MILLING AT BOTH ENDS of table, *with the same cutters*, is made possible with this double fixture set-up. It is a continuous cycle with the spindle head power feed being used to raise the cutters to clear the work which has just been loaded in the second fixture. Climb milling makes possible increased feeds and longer cutter life. Often permits efficient milling of pieces difficult to hold.

SHARPE

B·S

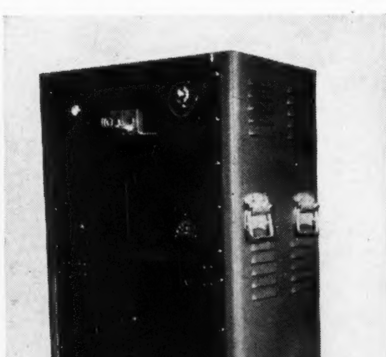


Black & Decker Impact Wrench

The first of a new line of portable electric impact wrenches announced by the Black & Decker Mfg. Co., Towson 4, Md., is the 3/8-inch wrench illustrated. This wrench will quickly tighten or remove either left- or right-hand nuts, bolts, and cap-screws. Light weight and minor torque reaction reduces operator fatigue. A reversing switch allows the unit to be used for either driving or removing fasteners. May be obtained with six hexagon sockets from 9/16 to 15/16 inch. 91

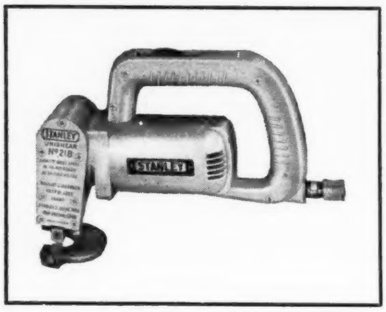
Electronic Heater

High-frequency heater designed for controlled, rapid brazing, soldering, and heat-treatment of metals. The unit has a maximum output of 3000 watts. It produces a powerful magnetic field that oscillates about one-half million times a second. Metals subjected to the magnetic field are heated in a matter of seconds. Accurate control makes it possible to obtain just the right amount of heat for each job. Announced by the Radio Frequency Corporation, Boston 34, Mass. 92



Stanley Unishear

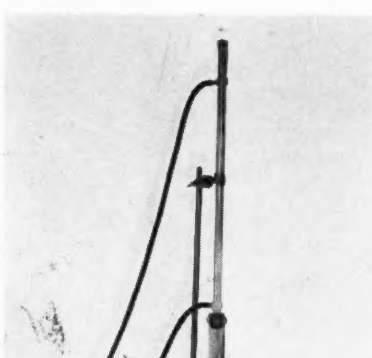
Unishear brought out by Stanley Electric Tools, Division of the Stanley Works, New Britain, Conn. This No. 218 tool will cut 18-gage mild hot-rolled steel or other materials in proportional weights at speeds up to 15 feet per minute. Improved blade action tends to draw the work in to the cutter, so that little effort is required by the operator for accurate



cutting to straight lines, curves, angles, and notches. The tool operates on 115 volts. Weight, 4 3/4 pounds. 93

Lindberg Laboratory Hot Plate

The Laboratory Division, Lindberg Engineering Co., 2444 W. Hubbard St., Chicago 12, Ill., is manufacturing a new Type H-5 1300-watt capacity, 115- to 230-volt, 60-cycle, hot plate which is specially designed for laboratory use in extraction, evaporation, and over-night concentration of analytical samples. The plate surface is 5 inches wide by 22 1/2 inches long. Temperatures are accurately controlled by a knob on the front of the plate. 94



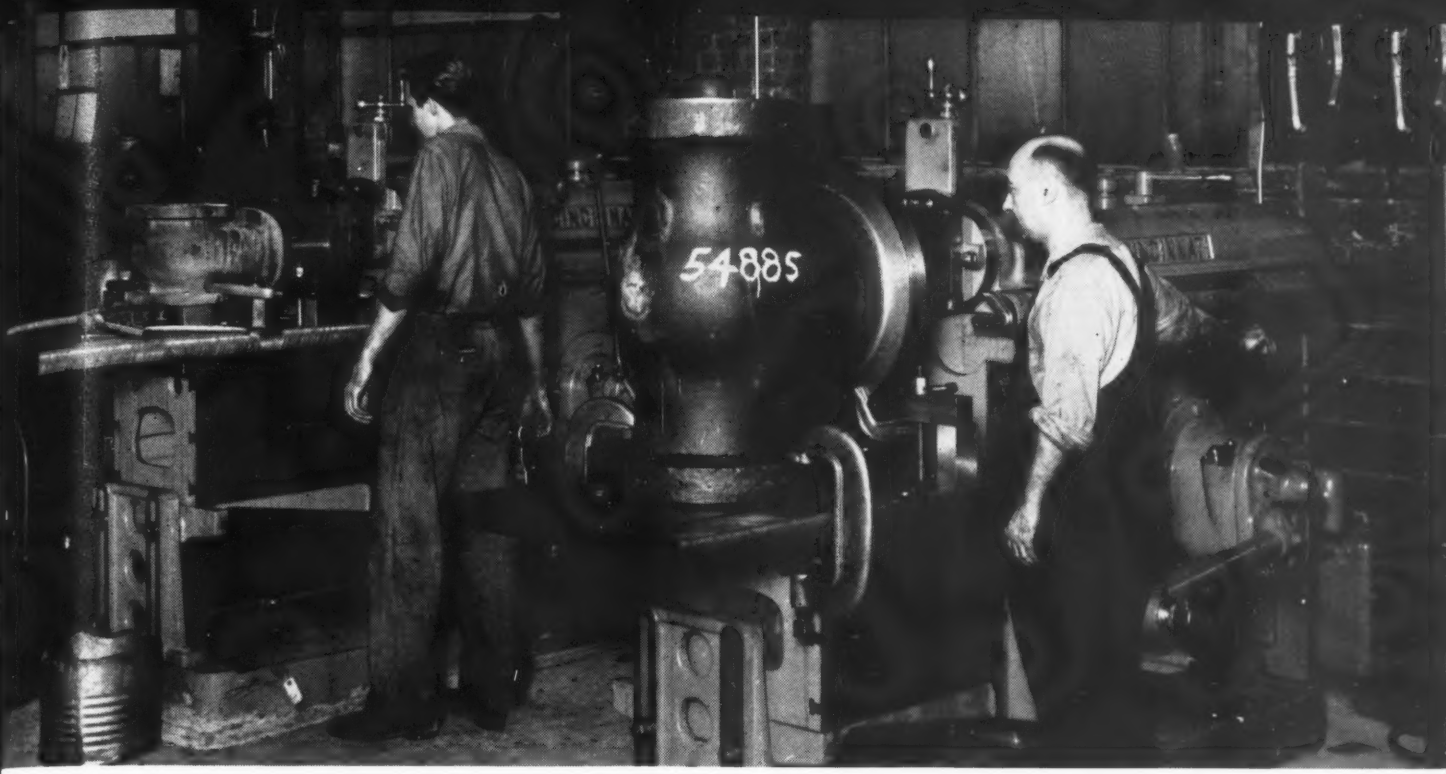
Buckeye "Stream-Power" Air-Driven Portable Grinders

The Buckeye Tools Corporation, 29 W. Apple St., Dayton 1, Ohio, has completely redesigned its line of "Stream-Power" vertical, air-driven portable grinders. Magnesium castings are used and power is provided by an internal-blade unit. A built-in oil reservoir insures proper lubrication. Replaceable Heli-Coil inserts in the castings provide steel-to-steel engagement of bolts to castings. Air flow is through the handle of the tool to the motor. Available speeds are 3100, 4000, 4500, 5500, and 6000 R.P.M. 95

Self-Winding Counter-Balancing Reel for Suspending Portable Tools

Self-winding reel that suspends portable tools for use on the production line and raises them out of the way when not needed. Reel tension is easily regulated to balance any tool weighing up to 10 pounds. This counter-balancing reel is made by Aero-Motive Mfg. Co., 1803 Alcott St., Kalamazoo 24, Mich. 96

To obtain additional information on equipment described on this page, see lower part of page 232.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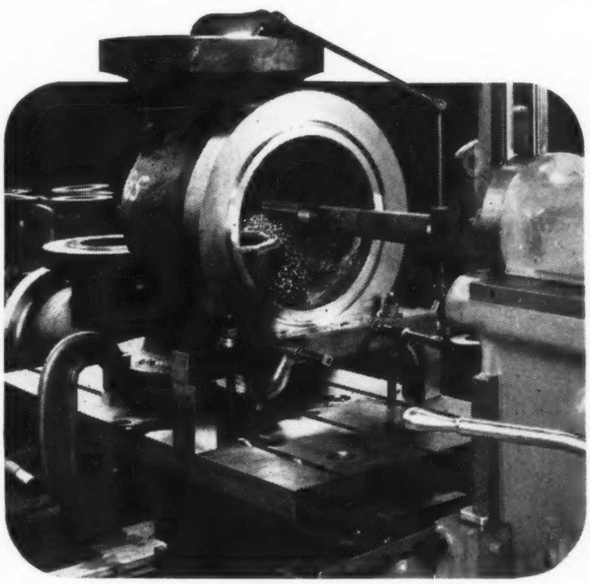
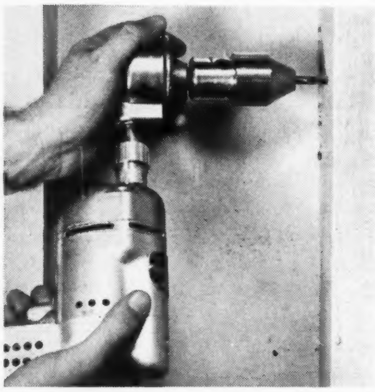


Right-Angle Attachment for Electric Drill

Right-angle attachment for electric drill, designed to permit drilling holes in places not accessible for direct drilling. The specially designed 1/2-inch Jacobs chuck fits the buffer, which, in turn, fits the chuck of any electric drill. The geared reduction provides increased drilling power by reducing the speed so that 1/2-inch drilling of wood or steel can be accomplished without damage to the 1/4-inch drill. This attachment is available from E. M. Bertram Engineering Co., 3121 Main St., Kansas City, Mo. 97

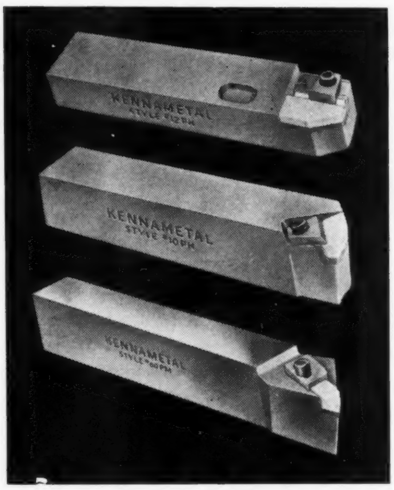


Hanna Solenoid-Operated Valve

New four-way solenoid-operated valve announced by the Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill. This small, compact unit is of the balanced spool type, controlled by a built-in solenoid pilot valve. Flexibility in the arrangement of the piping is provided by the use of a manifold. Time required for push-button response or for each stroke of valve spool is only 1/20 second. 98

Aro "Push-Pull" Tapper

"Push-pull" tapper recently added to line of portable air tools manufactured by the Aro Equipment Corporation, Bryan, Ohio. Simply pushing inward on this automatically reversible tapper causes the spindle to rotate in the forward direction, and pulling it back causes the direction of rotation to be reversed. Made in a pistol type, 11 inches long and weighing 3 pounds 9 ounces, as well as in a button and lever type, 10 1/2 inches long and weighing 3 pounds 1 ounce. Will tap holes up to 1/4 inch in diameter in 1/8-inch sheet steel, and can be used for cleaning up tapped holes in sizes up to 3/8 inch in diameter. 99

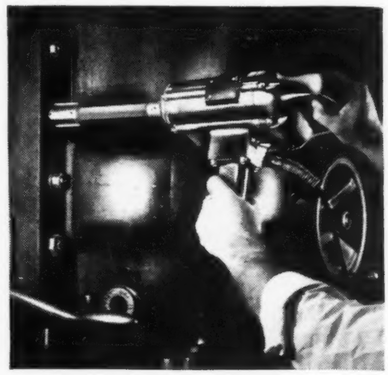


Kennametal Planer Tools for Machining Cast Iron

Kennametal, Inc., Latrobe, Pa., is now making a line of planer tools featuring clamped-on blades made of a newly developed Kennametal known as Grade K1. These tools have specially developed cutting angles and are said to be capable of removing 3 to 4 cubic feet of cast iron between regrinds when used in rigidly constructed planers having clapper-box lifters. Six different styles are available in various shank sizes. 100

High-Speed Impact Nut-Setter

Improved high-speed portable electric impact nut-setter announced by Speed-O-Matic Sales, Inc., sales agent for the Illinois Gage & Mfg. Co., 4639 W. Washington Blvd., Chicago 44, Ill. This universal 110-volt, 60-cycle, alternating- or direct-current model and high-cycle, 220-volt, 180-cycle, three-phase alternating-current models are available in sizes having capacities for setting nuts from 3/8 to 3/4 inch in diameter. These nut setters can also be used for drilling and tapping. At the point of resistance, the impact unit automatically delivers 3000 blows per minute,



tightening a 3/4-inch bolt with a torque of over 200 foot-pounds. The tool can be instantly reversed for removing bolts or nuts. The complete tool is 12 1/2 inches long and weighs 14 1/2 pounds. 101

Self-Aligning Swiveling Eye that Facilitates Die Lifting

Self-aligning swiveling eye designed for safe, convenient handling of dies, machine tools, and other heavy ob-

To obtain additional information on equipment described on this page, see lower part of page 232.

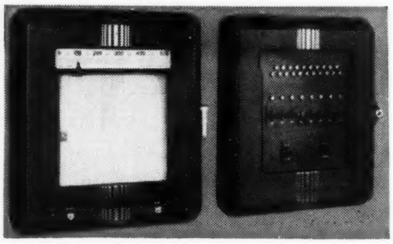
jects. The unit consists of a swiveling eye at the top which accommodates lifting hooks, and a stud assembly at the bottom which turns for attaching or removing the device to a die or other object to be lifted. Available in four sizes with maximum lifting capacities of 16, 28, 40, and 100 tons, and with studs 3/4, 1, 1 1/4, and 1 1/2 inches in diameter. Made by Modern Collet & Machine Co., 401 Salliotte St., Ecorse 18, Mich. 102

Hannifin Compressed-Air Conditioning Unit

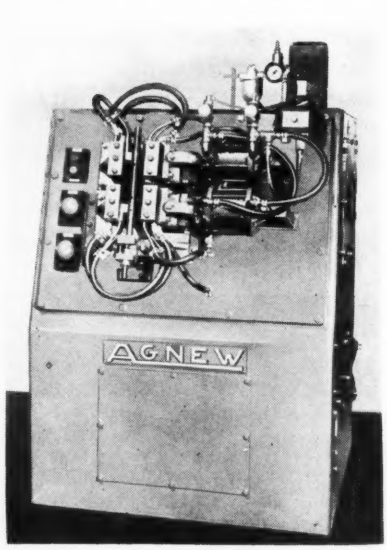
Combination unit for conditioning compressed air prior to its use in tools, cylinders, and other equipment. Announced by Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill. The new unit, which consists of a combination of the company's new "Air Warden" filter, pressure regulator, and lubricator, cleans and purifies the air, automatically controls its pressure, and adds atomized oil for the internal lubrication of moving parts in the air-powered equipment. The unit weighs about 10 pounds, and occupies only 12 inches of space in the air-supply line. The complete air-conditioning unit is regularly available in 3/8- and 1/2-inch sizes, but other sizes can be furnished on application. 103

"Speedomax" Indicator or Recorder

New "Speedomax" instrument brought out by the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa., which automatically records or logs as many as 160 separate thermocouple temperatures in succession at the rate of 4 seconds per point. Because each point is checked at high-frequency intervals, high or low temperatures can be spotted readily be-



fore they cause serious trouble. Under ordinary operating conditions, the instrument simply indicates, while numbered lights identify each couple. Should any temperature reach a preset limit, the "Speedomax" automatically starts its recording chart drive and operates an alarm. This equipment consists of two parts—a recorder and a switch assembly, housed in separate cases. 104



Agnew Resistance Heating Machine

Resistance heating machine for localized annealing of truck transmission shifter shafts which have been carburized and hardened and are to be straightened prior to grinding. This single-station air-operated machine will heat work from 3/8 to 7/8 inch in diameter by from 1 inch to 7 1/2 inches in length. Pressing the start button causes heating cycle to be performed automatically. Machine is also made in single-station or multiple-station types and can be pneumatically, hydraulically, or mechanically operated. Adapted for localized heating for bending or forming, heating blanks prior to forging or upsetting, and for brazing operations. Manufactured by the Agnew Electric Co., Milford, Mich. 105

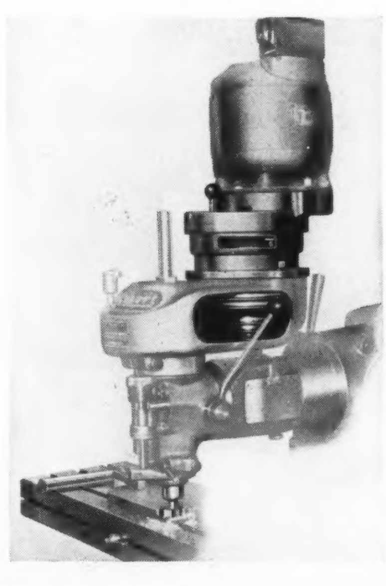
Milwaukee Heavy-Duty Pistol Type Electric Drill

Pistol-grip type electric drill, featuring light weight and reserve power, recently added to line of "Hole-Shooters" made by Milwaukee Electric Tool Corporation, 5344 W. State St., Milwaukee 8, Wis. Split housing design facilitates quick inspection and servicing of brushes and other parts. Available in three drill size capacities and five rated speeds (idle) —3/8 inch at 650 R.P.M., 5/16 inch

at 1000 R.P.M., and 1/4 inch at 2000, 3500, and 5000 R.P.M. Power supplied by A.C. or D.C. 115-volt universal type motor. Average weight 3 1/2 pounds. 106

Olson Two-Speed Gear-Head Attachment for Portable Milling Head

Two-speed gear-head which provides ratios of 1 to 1 and 6 to 1, shown mounted between driving motor and portable milling head, to double the

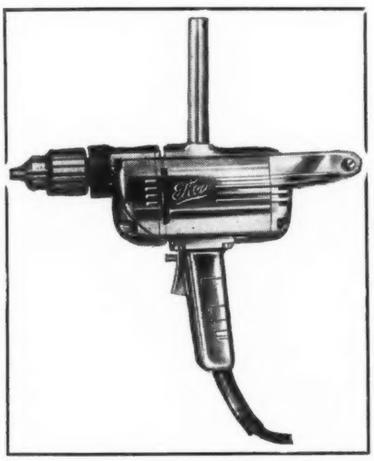


To obtain additional information on equipment described on this page, see lower part of page 232.

number of speeds available. With a six-step pulley, this equipment provides twelve speeds, ranging from about 45 to 4500 R.P.M. Although originally designed for a Bridgeport milling head, the attachment can be made to fit any similar type of head. Made by Olson Industrial Products, Inc., 40 W. Water St., Wakefield 59, Mass. 107

Thor "Silver Line" Portable Electric Drill

Thor 7-pound portable electric 1/2-inch "Silver Line" drill announced by the Independent Pneumatic Tool Co., 175 State St., Aurora, Ill. This new drill is designed for continuous, stall-free drilling through the toughest metals. A ventilating system with large slotted ports keeps the motor cool under heavy loads. The drill has a highly polished, die-cast case and removable dead handle. It has a free speed of 500 R.P.M., full ball-

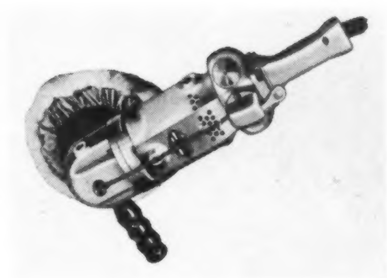


bearing construction, steel bearing inserts, removable switch handle, and three-jaw Jacobs key type chuck. The over-all length is 11 inches. . 108

Van Dorn Electric Polishers

The standard and automatic models of portable electric polishers made by the Van Dorn Electric Tool Co., Towson 4, Md., have recently been redesigned, as shown in the illustration. The speed of both models has been raised to 1500 R.P.M., and the power increased approximately 30 per cent.

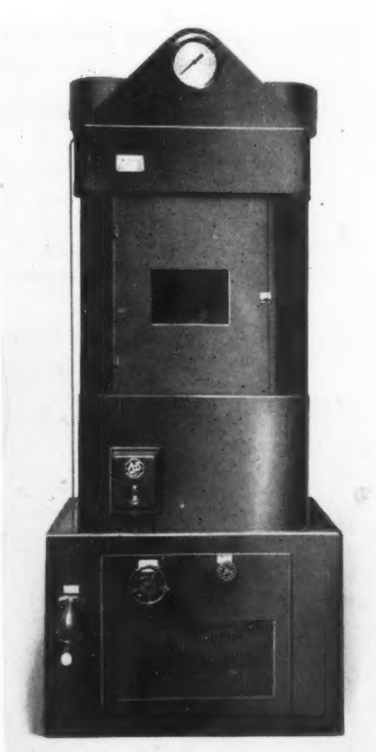
The plunger-button for controlling the "Power Glaze" cleaning fluid, which is fed from a reservoir at the handle end of the automatic polisher

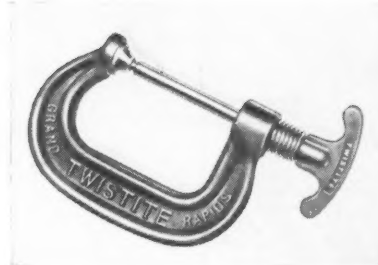


directly to the work, has been replaced by a lever, designed to reduce operator fatigue. Both polishers are equipped with 7-inch molded-rubber and sponge-rubber cushion pads and lambswool buffing pad. 109

M & N Hydraulic Hobbing Press

Hydraulic hobbing press with a platen pressure capacity of 1000 tons, recently added to the line of hydraulic presses manufactured by the M & N Machine Tool Works, Inc., 157 Orono St., Clifton, N. J. The ram has a stroke of 4 1/2 inches and a diameter of 21 inches. Each of the four columns is 5 3/4 inches in diameter. The opening is 14 inches high; 17 inches wide, left to right; and 30 inches from front to rear. The press requires a floor space of 48 by 48 inches, and is operated by a 3-H.P. motor. 110





"Twistite" Quick-Acting C-Clamp

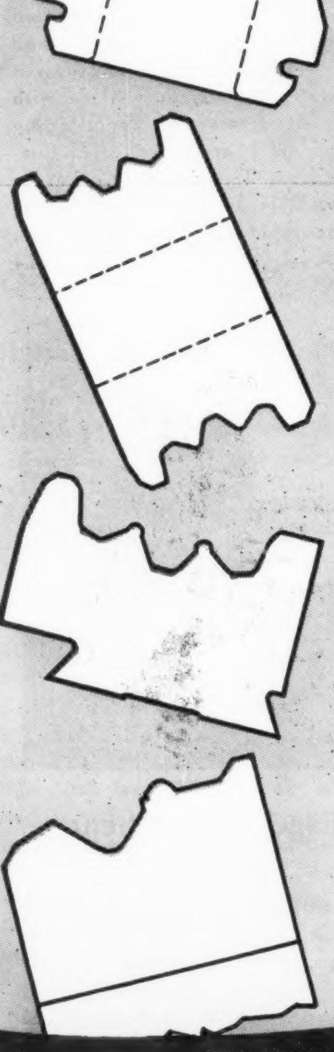
C-clamp, known as "Twistite," for use in shops and tool-rooms. It has a pressure bar that can be instantly pulled or pushed to any position from fully open to fully closed, and locked or unlocked by a single twist of the clamping handle. Made with deep-throat frames of super-strong malleable or heat-treated aluminum, in sizes from 2 to 6 inches. Larger sizes available on request from Richards Industries, Inc., Grand Rapids, Mich. 111

Shaper Attachment for Lathe

Shaper attachment designed to meet the needs of small experimental or die shops. Can be attached to any 9- or 10-inch lathe having a V-way at the front. Ram has a stroke range of from 3/4 inch to over 5 inches and receives its driving power from the lathe spindle. The table can be swiveled on the saddle. Feed is actuated by a link between the saddle and the lathe carriage. The vise can be set at any angle and has a maximum opening of 3 1/4 inches, but larger work can be easily clamped directly to the table, which has a travel of 6 inches. Brought out by C. G. Forsman Co., 914 Elliott St., S.E., Grand Rapids 7, Mich. 112

To obtain additional information on equipment described on this page, see lower part of page 232.

CRUSH GRINDING USUALLY COSTS LESS THAN YOU THINK!



FOR FLAT AND CYLINDRICAL WORK

Thousands of jobs are being turned out every day very much faster and at considerably less cost by CRUSH GRINDING than they could by any other method.

Of particular significance is the fact that CRUSH GRINDING does not necessarily require a large outlay for equipment. You may require only relatively inexpensive CRUSHTRUE Devices and Rolls to obtain the advantages of this method of grinding. A simple survey of your present equipment will determine that.

Very often the investment in CRUSHTRUE Devices for standard surface grinders will pay for itself in 30 days.

It will cost you nothing to find out about this method. Send us the prints of the work you contemplate and a list of your grinding equipment. We will then give you an estimate of whatever additional equipment you will need. Or—write for Representative to call at your plant.

Thread and Form Grinders, Microform and Visualform Grinders, Gear Chamfering, Burring and Burnishing Machines, Crushtrue Rolls and Fixtures, Special Machine Tools.

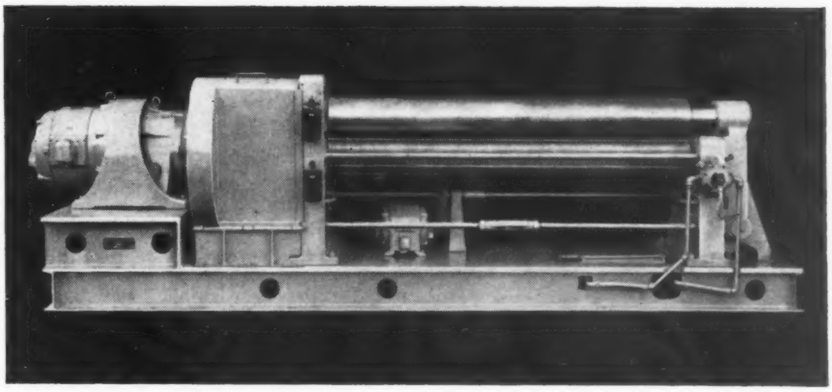
CRUSHTRUE HEADQUARTERS

the Sheffield corporation

Dayton 1, Ohio, U. S. A.

MASTER CRAFTSMEN SHEFFIELD HEADQUARTERS

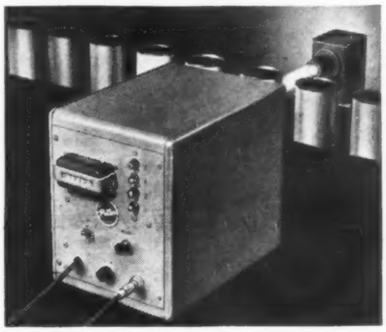
Metal Roll for Pipe Production



New metal roll for use in the production of pipe and well casing, as well as for general metal rolling. Designed and manufactured by the Valley Foundry & Machine Works, Inc., Fresno, Calif. This three-roll machine is capable of rolling heavy gage and alloy steels. The frame is all steel, and the rolls are of forged 4140 alloy steel. The unit has an alternating-current gear-head motor or a variable-speed slip-ring motor with separate gear-box. The rear bearing on the top roll is available for either manual or automatic air cylinder operation. Sizes and lengths are manufactured to suit requirements of users. 113

High-Speed Photo-Electronic Counter

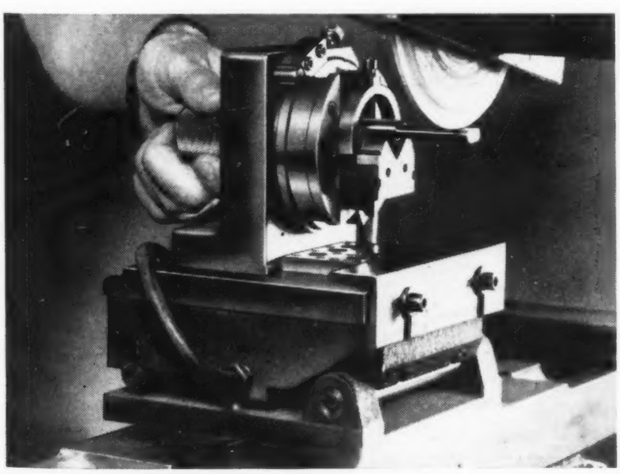
New Model 310 photo-electronic counter that can be used at counting rates up to 6000 per minute. Made by Potter Instrument Co., Inc., 136-56 Roosevelt Ave., Flushing, N. Y. This counter is a self-contained unit, including a photo-electronic detector, an electronic decade and a six-digit



electro-mechanical register. Small sized objects, as well as closely spaced parts, can be accurately counted, since the width of the photo-electric beam is only 1/4 inch and responds to light changes as small as 25 per cent. An electronic counter is also available for use with an electromagnetic pick-up coil for counting shaft rotations without physical contact with the rotating shaft. The detector coil is mounted close to a disk or steel slug on the shaft, the revolutions of which are to be counted. This detection system is not affected by dirt or oil. 114

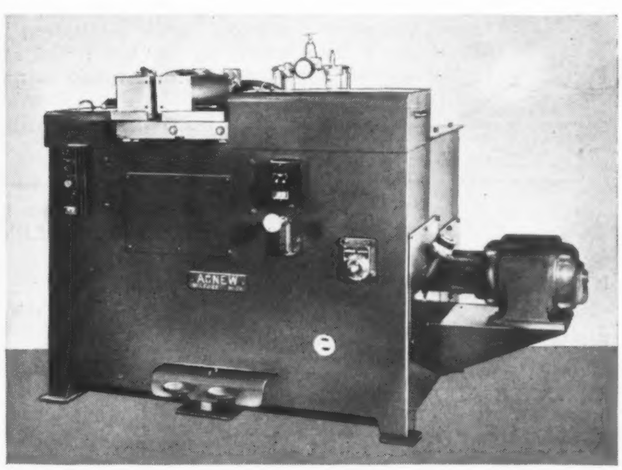
Harig "Grind All" Fixture

"Grind All" fixture designed to provide a faster and more versatile means for precision-grinding formed punches, announced by the Harig Mfg. Corporation, 319 N. Albany Ave., Chicago 12, Ill. Accurate set-ups can be made quickly for grinding all types of regular and irregular contours. Many irregular-shaped punches can be ground within limits of $\pm$ 0.0002 inch. Adjustable stops permit rotating the work through any desired angle. The V-block located in the center of the index-plate can be adjusted to any position within $\pm$ 0.0002 inch. The index-plate has twenty-four 15-degree graduations which are accurate within $\pm$ 0.0002 inch. The fixture can be used for concave and convex radius dressing, and because of its radius generating feature, can also be used to advantage in grinding carbide tools. 115

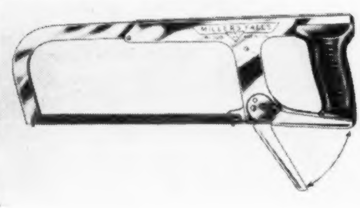


Hydraulically Operated Flash Welder

The Agnew Electric Co., Milford, Mich., has brought out a hydraulically operated flash welder which is completely automatic in operation, except for loading and unloading the work. The hydraulic pump supplies pressure for actuating the movable platen, a flow valve controls the flash cycle, and compressed air is used for clamping. The dies are replaceable inserts designed to minimize costs and to broaden the field of application. A tap switch on the transformer provides a wide heat range control for diversified production. The machine is equipped with water-cooled 50-K.V.A. transformer and clamps, welder type magnetic contactor, and all necessary pressure controls. It has a height to the platen of 36 inches, requires a floor space of 3 feet by 4 feet, and weighs approximately 2000 pounds. 116



To obtain additional information on equipment described on this page, see lower part of page 232.

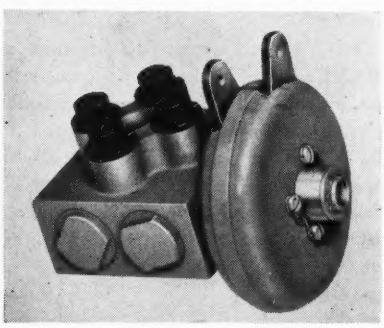


Millers Falls Hacksaw Frame

Hacksaw frame with lever-action blade-tightening device designed to facilitate quick changing of blades and to provide more uniform tension on the blade. Adjustable for either 10- or 12-inch blades, which can be inserted with teeth facing in any of four directions. Introduced by Millers Falls Co., Greenfield, Mass. . . 117

Electrol Selector Valve

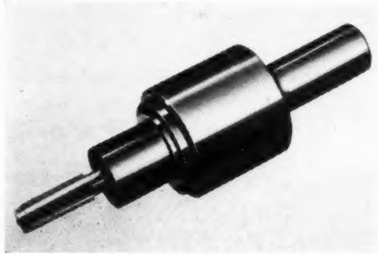
Selector valve designed for manual or automatic operation. Can be adapted to mechanical hydraulic systems of machine tools or marine equipment for such applications as maintaining equal tension, multiple brake actuation, furnace control, steering devices, etc. It is light in weight, easy to install, and available



in sizes to meet specific requirements. Announced by Electrol, Inc., Kingston, N. Y. 118

Floating-Releasing Type Tap-Holder

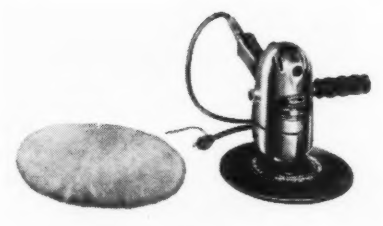
Floating-releasing tap-holder designed to reduce set-up time, prolong tap life, lessen tap breakage, and eliminate bell-mouthed holes. The amount



of float is adjustable, and the holder can be easily changed for right- or left-hand operation. Made to take taps from 1/2- to 1 1/4-inch sizes, with 1 1/2- by 4-inch shank, for use in all makes of turret lathes and automatics. Announced by the Empire Tool Co., 8774 Grinnell Ave., Detroit 13, Mich. 119

Bradford Portable Electric Polisher

New 10-inch vertical type polisher added to line of "Metalmaster" portable electric tools made by the Bradford Machine Tool Co., Cincinnati, Ohio. Especially designed for rapid polishing of all types of smooth metal and non-metallic surfaces. The side handle can be attached to either the



right- or left-hand side of the polisher. A spindle lock permits quick changing of polishing pads. The universal 110-volt, 25- to 60-cycle motor operates at 1000 R.P.M., free speed, and at 700 R.P.M. when under load. 120

Cleco Pneumatic Impact Wrench

Pneumatic reversible impact wrench with rated nominal capacity for handling 3/8-inch bolts. Recently added to line of pneumatic tools made by Cleco Division of Reed Roller Bit Co., Box 2119, Houston, Tex. In addition to bolt and nut running, this tool is adapted for such operations as reaming, tapping, stud-setting, and drilling. It is applicable for all types of production, assembly, and maintenance work. . 121

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in January, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 238 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January, 1949, Number of MACHINERY

Portable Pneumatic Tools

ROTOR TOOL CO., Cleveland, Ohio. Bulletin 35, containing data intended to help the user select the right portable pneumatic drill, screwdriver, grinder, etc., for a particular job on the production line or in the assembly plant. Typical case histories showing increases in production and savings in cost effected by the use of these tools are included. 1

Magnetic Gages

PRATT & WHITNEY DIVISION, NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 512, descriptive of the line of "Magnetic" continuous gages recently acquired by the company from the Magnetic Gage Co., of Akron, Ohio. Also described is the "Magnetic" Schuster gage for checking thicknesses of non-magnetic, non-conductive materials. 2

Multiple-Spindle Drilling and Tapping Machines

NATIONAL AUTOMATIC TOOL CO., Department 40, Richmond, Ind. Bulletin 648, containing complete information on the company's new line of Model C "Holesteel" Type B adjustable, multiple-spindle, general-purpose drilling and tapping machines. Case histories are included. 3

Surface Roughness Control

PHYSICISTS RESEARCH CO., 321 S. Main St., Ann Arbor, Mich. Bulletin entitled "More Profits to You through Surface Control," describing applications of the latest surface control methods and defining the basic requirements of a system for the control of irregularities on machined, ground, and finished surfaces.....4

Pipe-Threading Equipment

OSTER MFG. CO., E. 61st Place at Carnegie Ave., Cleveland 3, Ohio. Pamphlet entitled "The Muscle Misers—Adventures in Pipe Threading," describing in story form, illustrated by cartoons, the savings effected by the use of the Oster power vise stand, a portable unit designed to motorize hand pipe tools. 5

Shielded-Arc Welding Process

AIR REDUCTION SALES CO., Department 2313, 60 E. 42nd St., New York 17, N. Y. Folder containing an article entitled "Development of the Gas-Shielded Metal Arc-Welding Process," by Jesse S. Sohn and A. N. Kugler, presented as a paper before the meeting of the American Welding Society. 6

Centerless Grinding Wheels

SIMONDS ABRASIVE CO., Philadelphia 37, Pa. Bulletin ESA55, entitled "The 'Pay-Off' Wheel that Gives Full Benefits from Centerless Grinding," containing field reports on the results obtained with these wheels and wheel recommendations for grinding all types of metal. 7

Die Try-Out and Assembly Machine

MOORE SPECIAL TOOL CO., INC., Bridgeport, Conn. Catalogue on the Moore "Die Flipper," a die try-out and assembly machine that enables a single diemaker to test alignment of dies, drill punches in place, tap for screw holes, and inspect visually. 8

Surface Broaching Machines

LAPOINTE MACHINE TOOL CO., Hudson, Mass. Bulletin SRV, illustrating and describing Lapointe single-ram, variable-speed hydraulic surface broaching machines. Bulletin DRV, descriptive of Lapointe double-ram variable-speed hydraulic surface broaching machines. 9

Speed Control Device

MILWAUKEE LOCK & MFG. CO., 5078 N. 37th St., Milwaukee 9, Wis. Bulletin entitled "The Application of Small Mechanical Differentials to Instrument and Control Work," describing a speed controlling and measuring device suitable for a wide range of applications. 10

Wire Rope

COLORADO FUEL AND IRON CORPORATION, WICKWIRE SPENCER STEEL DIVISION, 500 Fifth Ave., New York 18, N. Y. Fiftieth anniversary catalogue containing 187 pages covering the characteristics of wire rope, applications in specific industries, and care and handling. 11

Cold-Finished Steel Bars

JOSEPH T. RYERSON & SON, INC., Box 8000-A, Chicago 80, Ill. Bulletin on cold-finished steel bars, containing a description of the finishing processes, guide to selection, A I S I and S A E standard steel compositions, and other technical data. 12

Metal Marking Dies

METAL MARKER MFG. CO., 1384 E. 40th St., Cleveland 3, Ohio. Circular entitled "Portfolio of Artistry in Steels," showing a

number of marking dies and stamps for product identification, built to individual specifications by this company. 13

Cam Eyelet Machines

WATERBURY FARREL FOUNDRY & MACHINE CO., Waterbury 86, Conn. Catalogue 928-E, illustrating and describing automatic multiple-die cam eyelet machines for producing parts from thin strip metal in progressive operations. 14

Hand Measuring Tools and Precision Instruments

L. S. STARRETT CO., Athol, Mass. Pamphlet entitled "The Starrett Story," containing a brief account of the origin and development of the company and of its line of measuring tools and precision instruments. 15

Industrial Diamonds and Tools

ANTON SMIT & CO., INC., 333 W. 52nd St., New York 19, N. Y. Circular 7, entitled "Industrial Diamonds and Diamond Tools," containing suggestions for selecting the proper tool for a specific job and points on the most efficient use of these tools. 16

Forming and Cutting-off Tool Blanks

PRODUCTION SERVICE CO., 1060 Broad St., Newark 2, N. J. Pamphlet illustrating and describing the company's complete line of circular forming and cutting-off tool blanks for automatic screw machines. 17

Pneumatic and Hydraulic Cylinders

ORTMAN-MILLER MACHINE CO., INC., 1222-150th St., Hammond, Ind. Catalogue containing specifications of air, hydraulic, and water cylinders designed particularly for the machine tool industry. 18

Coupling Selector

FALK CORPORATION, 3010 W. Canal St., Milwaukee 8, Wis., is distributing a new slide-rule Steelflex coupling selector, designed to aid draftsmen, engineers, designers, and others in selecting flexible couplings. 19

Air Cylinders

HYDRO-LINE MFG. CO., 711 Nineteenth St., Rockford, Ill. Catalogue A-48, describing the company's new line of air cylinders. Catalogue H-48-LP, covering Hydro-Line hydraulic cylinders for low-pressure applications. 20

Phosphor-Bronze Products

PHOSPHOR BRONZE CORPORATION, 2200 Washington Ave., Philadelphia 46, Pa. Technical data book containing information on the properties, chemical analyses, and uses of phosphor-bronze. Spring design and machinability data are included.....21

Power Factor

ELECTRIC MACHINERY MFG. CO., Minneapolis 13, Minn. Booklet 200-TEC-1077, explaining the essentials of power factor in industrial plants, and giving a digest of power factor calculation and methods of correcting low power factor. 22

Milling Machine and Drill Press Converters

LEO G. BROWN ENGINEERING CO., 1531 S. Sunol Drive, Los Angeles 23, Calif. Circular describing milling machine and drill press attachments and electric universal tool suitable for a wide range of operations. 23

Turret Lathes

WARNER & SWASEY CO., Cleveland 3, Ohio. Bulletin entitled "When the Going Gets Tough, Put It on a Warner & Swasey," describing production records made by Warner & Swasey turret lathes using carbide tools.........24

Nickel-Alloy Steel Castings

INTERNATIONAL NICKEL CO., 67 Wall St., New York 5, N. Y. Publication describing the application of nickel-alloy steel castings in various industries, together with composition and properties of different alloys.....25

Ball Bearings

NORMA-HOFFMANN BEARINGS CORPORATION, Stamford, Conn. Booklet describing the many applications of the "Cartridge" ball bearing, and giving dimensional data, load rating, and other information. 26

Clutches

L. G. S. SPRING CLUTCH CORPORATION, DIVISION CURTIS WRIGHT CORPORATION, Indianapolis 6, Ind. Bulletin 948, announcing a new line of "Steelgrip" spring clutches applicable to gasoline engine and electric motor drives. 27

Design for Welding

JAMES F. LINCOLN ARC WELDING FOUNDATION, Cleveland, Ohio. Pamphlet entitled "Design for Welding," describing the economies and advantages obtained by the use of welded designs and showing typical examples. 28

Oil-Operated Pumps

AMERICAN ENGINEERING CO., Philadelphia 25, Pa. Catalogue J, illustrating and describing Hele-Shaw variable-discharge, oil-operated pumps and controls, both high and low pressure. Engineering data is included. 29

Overhead Trolley Conveyors

LINK-BELT CO., 307 N. Michigan Ave., Chicago 1, Ill. Catalogue 2330, entitled "Make Ceilings Pay Dividends," showing a great variety of installations of Link-Belt overhead trolley conveyors. 30

Materials-Handling Equipment

BARRETT-CRAVENS CO., 4609 S. Western Blvd., Chicago 9, Ill. Junior Catalogue 487, containing data on the Barrett line of materials-handling equipment, including lift-trucks, hoists, elevators, cranes, etc. 31

Extruded Shapes

TITAN METAL MFG. CO., Bellefonte, Pa. Circular showing typical examples of brass and bronze extrusions and giving chemical composition and physical properties of the alloys used for Titan extruded shapes. 32

Precision Jig-Borer

HAUSER MACHINE TOOL CORPORATION, Manhasset, N. Y. Bulletin giving complete details and specifications covering a high-precision automatic jig-borer produced by Henri Hauser, Ltd., of Bienne, Switzerland. 33

Thermo-Couple Manual

WHEELCO INSTRUMENTS CO., Chicago 7, Ill. Bulletin T/C7 containing 40 pages of data on thermo-couples — their selection, methods of checking, and installation suggestions. 34

Pneumatic Control

LEEDS & NORTHRUP Co., 4934 Stenton Ave., Philadelphia 44, Pa. Catalogue ND4B, descriptive of a complete air-actuated control system of advanced design for use in a variety of industries. 35

Air Cylinders

GEROTOR MAY CORPORATION, Baltimore 3, Md. Catalogue Section 53, illustrating and describing the Gerotor line of air cylinders designed to help the engineer lay out his air circuit. 36

Hydraulic Punching Units

PROGRESSIVE WELDER Co., Detroit 34, Mich. Bulletin 51-48, descriptive of the company's new line of hydraulic punching units with cylinders interchangeable on different types of bases. 37

High-Speed Power Presses

V & O PRESS Co., Hudson, N. Y. Bulletin containing complete specifications for the Stockmaster line of high-speed power presses built in a range of sizes from 10 to 90 tons pressure. 38

Precision Lathes

SOUTH BEND LATHE WORKS, 383 E. Madison St., South Bend 22, Ind. Catalogue 73, descriptive of the new South Bend 13- and 14 1/2-inch swing precision lathes. 39

Jig-Boring Machine

COSA CORPORATION, 405 Lexington Ave., New York 17, N. Y. Catalogue 948, illustrating and describing latest types of Sip Hydroptic precision jig-boring machines. 40

Tungsten Electrodes

FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill. Bulletin 1.102, describing the use of Fansteel tungsten electrodes for inert-gas and atomic-hydrogen welding. 41

Press Unloader

SAHLIN ENGINEERING Co., 467 S. Woodward Ave., Birmingham, Mich. Folder illustrating and describing a new press unloader (the "Iron Hand") designed to increase production and safety...42

Carbide-Tipped End-Mills

LOVEJOY TOOL Co., INC., Springfield, Vt. Circular containing specifications for the new line of Lovejoy carbide-tipped end-mills and holders. 43

Band-Sawing Machines

DOALL Co., Des Plaines, Ill. Circular describing DoAll low-cost utility band saws, adapted for handling wood-, plastic-, and metal-cutting jobs. 44

Hacksaw Blades

CLEMSON BROS., INC., Middletown, N. Y. Folder containing dimensions, weights, and prices for Star hand and power hacksaw blades and band saws. 45

Chromium-Plated Gage-Blocks

DEARBORN GAGE Co., 22035 Beech St., Dearborn, Mich. Catalogue on Ellstrom chromium-plated gage-blocks for measuring in millionths of an inch. 46

Meehanite Castings

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Bulletin 30, entitled "Meehanite Means Better Castings." 47

Power Belt Conveyors

RAPIDS-STANDARD Co., INC., Grand Rapids 2, Mich. Circular FV-48, descriptive of the "Floor-Veyor" escalator type power belt conveyor. 48

Weld Tube Mills

YODER Co., 5500 Walworth Ave., Cleveland 2, Ohio. Publication containing 64 pages of technical data on electric-resistance weld tube mills. 49

Portable Air Tools

BUCKEYE TOOLS CORPORATION, Dayton 1, Ohio. Chart developed to enable users of portable air tools to obtain maximum production from these tools. 50

Bench Shears

H-A MFG. Co., Box 346, York, Pa. Leaflet giving specifications for the company's 18-inch throat high-speed nib-shears. 51

Welding Machines

DOALL Co., Des Plaines, Ill. Circular on the new DoAll pedestal and table model flash- and butt-welders. 52

Alloy-Steel Chain

S. G. TAYLOR CHAIN Co., Box 509, Hammond, Ind. Booklet on the inspection, care and use of "Taylor-Made" alloy-steel chain. 53

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (January, 1949) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME..POSITION OR TITLE..

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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By E.S.S.

BETWEEN GRINDS

Magazine Goes to College

Nineteen copies of October MACHINERY were towed away from our office by a messenger from New York University for use by a professor in an industrial advertising course. By the process of deduction we have assumed that the professor has selected our magazine as a model for high standards in advertising. Correct, Holmes?

A Case of Space

A technical publicity and editorial relations outfit who had been victims of the New York City "officing" shortage informed their "clients, editors, suppliers, and friends" of their change of address: "With relief Harry W. Smith, Inc., announces a long-sought solution to its housing problem" and went on to describe how the personnel could now work without skipping rope over extension cords, using pockets in lieu of desk drawers, and conducting interviews in the hall. This reminds us of the experience of a buxom young lady we know in applying for a position. The prospective employer pondered and then stated regretfully that her qualifications were excellent but (and he gazed around his cubicle) dimensionally speaking, she just wouldn't fit into his organization.

An Eastern Slant

In August we mentioned that a Japanese magazine called "Machinery" had come to our notice. Since then we have received a very informative letter from Mr. S. Miyazaki, consulting editor of that magazine (he penned in his name, which looked somewhat like this: ">=,+'—") and also chief of the research division of the Machine Tool Association in Tokyo, from which we quote:

"We found in your August issue that you suggested our existence. So we wish to introduce ourselves to you. Our periodical was started in 1937 by much support from field engineers and scholars. Now we have the circulation of 6000 every month and rank the top in the engineering magazines in Japan.

"As you know, Japan is now facing on the unbalanced economy and most important industries can hardly manage in normal conditions. It is not to say too much that the machinery lines is one of the worst. Reflecting from this, our management of magazine is not so easy but we are convinced that Japanese rehabilitation, needed for all reconstruction and peace of the Orient, must be started by the machinery, mainly machine tools, and we should act as its promoter. We wish you will kindly help us to rebuild peaceful world."

A Tale of the Road

Specialties, Inc., wrote to us that their engineering department would like tear sheets of the article "The Design of Dynamically Loaded Extension and Compression Springs" (two installments in July and August MACHINERY). We sent them to the company, duly noting their very di-stinct-ive address: Skunks Misery Road, Syosset, Long Island.

The Toiling Engineer—Contributor FRANK H. MAYOH, Rhode Islander, made his debut in May, 1915, MACHINERY, with a four-page article on chain making, and was introduced to our readers via an oval picture which showed a serious, pleasant young man with the high stiff collar of those days, staring intently at the camera. He had already served his apprenticeship with the J. M. Carpenter Tap & Die Co. and been associated with several New England firms. His progress was typical of the ambitious design engineer's—obtaining patents, writing technical articles, joining the A.S.M.E.

(in 1920), teaching evenings at the Pawtucket School of Industrial Arts, and always working as a design staff or project engineer. During the past war, for instance, he was a chief project engineer on machine gun production. Thus, in the thirty-three years between pictures, Mr. Mayoh garnered a well-rounded career for himself. To make sure that he, himself, is not too well-rounded, however, Mr. Mayoh indulges in some active swimming. Our seasoned contributor starts off the year '49 with another of his welcome articles—about a gear and link mechanism (page 193).

News of the Industry

California and Washington

Richards Machine Tool Co., manufacturer of "Rimat" machine tools and micrometers, announces that the company is to be known in the future as the Rimat Machine Tool Co. Coincident with the change in name, the plant and offices of the company have been moved to new and larger quarters at 1117 Air Way, Glendale 1, Calif. It is also announced that Karl M. Joehnck has been named sales manager of the company.

General Electric Co. announces the opening of a $3,000,000 motor manufacturing plant at San Jose, Calif. The new plant, at peak production, will be able to turn out more than 1500 electric motors weekly. The factory has 144,000 square feet of floor space, and is situated on a 57-acre tract which provides ample space for expansion.

Thomas J. Lingle has been appointed western division manager in charge of manufacturing operations at the new Fontana, Calif., plant of the Taylor Forge & Pipe Works, Chicago, Ill. He will also direct West Coast sales.

Lee Cameron has been elected president and general manager of Superweld Corporation, 708 Hawthorne St., Glendale 4, Calif., to succeed Walter T. Wells, who has been named chairman of the board.

L. G. Maechtlen has been named general sales manager of the Square D Co., Western Division, Los Angeles 42, Calif. Mr. Maechtlen has been connected with the company since 1926.

Hammond Machinery Builders, Inc., Kalamazoo, Mich., announces the opening of a new office at 1021 E. 8th St., Los Angeles 21, Calif., with E. C. Hammett as western representative.

Tabor Mfg. Co., Philadelphia, Pa., has appointed the Pacific Graphite Co., Inc., 40th and Linden Sts., Oakland 8, Calif., agent for the company in California north of Fresno.

Twin Disc Clutch Co., Racine, Wis., has recently constructed a 50- by 70-foot building at 1214 Westlake Ave., North, Seattle, Wash., to increase the service facilities of the company in the Pacific Northwest. All West Coast operations of the company are under the direction of A. E. Young. Paul W. Wahler is assistant district manager at Seattle, and Jack H. McCumber is office manager.

Illinois

R. C. Brown has been appointed director of sales for Foote Bros. Gear & Machine Corporation, Chicago 9, Ill. Mr. Brown was formerly president of the Brown-Steele Co., of Dallas, Tex. Previous to that connection, he was associated for twenty-one years with the Link-Belt Co.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has begun construction on a large brick and steel addition to its Chicago plant, which will provide approximately 118,000 square feet of plant and office space. The building is scheduled to be completed next November.

C. M. Murray, Ltd., 306 Foy Bldg., Toronto, Ontario, Canada, has been appointed exclusive representative in the provinces of Quebec and Ontario for the line of air and hydraulic cylinders and special machinery made by the Hydro-Line Mfg. Co., Rockford, Ill.

Wheelco Instruments Co., Chicago, Ill., announces the opening of a new district office at 2204 Fannin St., Houston 5, Tex. The new office will be under the direction of George Hatfield, formerly of the Chicago sales office.

M. G. McGregor has been appointed sales manager of the Ahlberg Bearing Co., Chicago, Ill. He was previously manager of replacement bearing sales, and has been connected with the company for twenty-two years.

Richard W. Schreck has been appointed Michigan divisional sales representative for the Watson-Stillman Co., Roselle, N. J. Mr. Schreck's headquarters will be at Chicago, Ill.

Michigan

John L. Cook, until recently president of the Winter Brothers Co., Wrentham, Mass., manufacturer of taps and dies and a subsidiary of the National Twist Drill & Tool Co., Rochester, Mich., has been elected president of the National Machine Products Co., Detroit, Mich., manufacturer of alloy-steel nuts and valve tappet screws. He succeeds the late Clare L. Brackett, who had been president since 1916. Mr. Cook will retain the office of vice-president and director of the National Twist Drill & Tool Co.

Harry Crump, for the last year manager of cutting tool sales engineering for the Carboloy Company, Inc., Detroit, Mich., has been named assistant to the sales manager. J. S. Gillespie, formerly in charge of wear parts sales engineering, has been appointed manager of tool and wear parts sales engineering, succeeding Mr. Crump. A. F. Dobbrodt, previously special products sales engineer, has been made manager of mining sales engineering.

John E. Wells has joined the newly formed Industrial Parts Division of the Reynolds Metals Co., Louisville, Ky., as special sales representative. He is located at the Detroit office of the company. Prior to his present connection, Mr. Wells was associated for five years with the Avco Mfg. Corporation of Detroit, Mich., in various capacities, including plant manager and general manager.

Kelly Reamer Co., Cleveland, Ohio, announces the appointment of G. Henry Keeton, 6432 Cass Ave., Detroit, Mich., as sales and engineering representative for the company in the state of Michigan.

J. B. Scott has been appointed quality control manager of the Borg-Warner Corporation's Ingersoll Steel Division Plant at Kalamazoo, Mich.

New England

T. W. Baush has been appointed general export sales manager of all divisions of the Van Norman Co.,

T. W. Baush, General Export Sales Manager of Van Norman Co. and Morse Twist Drill & Machine Co.

MACHINERY'S DATA SHEETS 625 and 626

CLASSIFICATIONS AND COMPOSITIONS OF COPPER-BASE INGOT ALLOYS

Classification	Alloy Number (NFIMI)	A.S.T.M. Designations		Nominal Chemical Composition, Per Cent				
		Ingots	Castings	Copper	Tin	Lead	Zinc	Others as Noted
Leaded Tin Bronze	2A	B30-45T(2A)	B143-46T(2A)	88	6	1.5	4.5	—
	2B	B30-45T(2B)	B143-46T(2B)	87	8	1	4	—
	2C	B30-45T(2C)	B143-46T(2C)	87	10	1	2	—
High-Leaded Tin Bronze	3A	B30-45T(3A)	B144-46T(3A)	80	10	10	—	—
	3B	B30-45T(3B)	B144-46T(3B)	83	7	7	3	—
	3D	B30-45T(3D)	B144-46T(3D)	78	7	15	—	—
	3E	B30-45T(3E)	B144-46T(3E)	71	5	24	—	—
Leaded Red Brass	4A	B30-45T(4A)	B145-46T(4A)	85	5	5	5	—
	4B	B30-45T(4B)	B145-46T(4B)	83	4	6	7	Ni 0.75
Leaded Semi-Red Brass	5A	B30-45T(5A)	B145-46T(5A)	81	3	7	9	Ni 0.75
	5B	B30-45T(5B)	B145-46T(5B)	76	3	6	15	—
Leaded Yellow Brass	6A	B30-45T(6A)	B146-46T(6A)	71	1	3	25	—
	6B	B30-45T(6B)	B146-46T(6B)	67	1	3	29	—
	6C	B30-45T(6C)	B146-46T(6C)	60	1	1	38	—
Leaded High-Strength Yellow Brass (Manganese Bronze)	7A	B30-45T(7A)	B147-46T(7A)	59	0.75	0.75	37	Fe 1.25 Al 0.75
High-Strength Yellow Brass (Manganese Bronze)	8A	B30-45T(8A)	B147-46T(8A)	58	—	—	39	Fe 1.25 Al 1.25
	8C	B30-45T(8C)	B147-46T(8C)	62	—	—	26	Fe 3 Al 5.5 Mn 3.5
Aluminum Bronze	9A	B30-45T(9A)	B148-46T(9A)	87.5	—	—	—	Fe 3.5 Al 9
	9B	B30-45T(9B)	B148-46T(9B)	89	—	—	—	Fe 1 Al 10
	9C	B30-45T(9C)	B148-46T(9C)	86	—	—	—	Fe 4 Al 10
	9D	B30-45T(9D)	B148-46T(9D)	79	—	—	—	Fe 5 Al 11 Ni 5
Leaded Nickel Brass (Nickel Silver)	10A	B30-45T(10A)	B149-46T(10A)	57	2	9	20	Fe 1 Ni 12
	10B	B30-45T(10B)	B149-46T(10B)	60	3	5	16	Fe 1 Ni 16
Leaded Nickel Bronze (Nickel Silver)	11A	B30-45T(11A)	B149-46T(11A)	64	4	4	8	Fe 1 Ni 20
	11B	B30-45T(11B)	B149-46T(11B)	66.5	5	1.5	2	Fe 1 Ni 25

MACHINERY'S Data Sheet No. 625, January, 1949

Compiled by the
Non-Ferrous Ingot Metal Institute

PHYSICAL PROPERTIES OF COPPER-BASE INGOT ALLOYS

Alloy Number (NFIMI)	Minimum Tensile Strength, Pounds per Sq. In.	Minimum Yield Strength, Pounds per Sq. In.	Elongation, Per Cent in 2 Inches	Modulus of Elasticity, Millions of Pounds per Sq. In.	Brinell Hardness, (10-mm. Ball, 500-kg. Load)	Weight, Pounds per Cubic Inch	Description and Typical Uses
2A	36,000	16,000	25–40	12.0–16	60–72	0.311–0.318	Steam or valve bronze
2B	33,000	16,000	18–30	10.6–16	60–75	0.314–0.320	General-utility structural bronze
2C	36,000	18,000	15–25	10.6–16	65–80	0.314–0.320	Commercial bronze; wear-resistant service
3A	27,000	15,000	8–12	8.5–13	55–70	0.321–0.329	General-purpose bearing or bushing alloy
3B	30,000	17,000	12–20	14.5	55–65	0.320–0.322	General-purpose bearing or bushing alloy
3D	25,000	14,000	10–18	8.8–12.6	50–60	0.329–0.340	Large castings; moderate-pressure bearings
3E	23,000	11,000	7–16	9.0–12	42–55	0.332–0.343	High-speed, lightly loaded bearings
4A	33,000	17,000	20–35	9.1–14.8	55–65	0.314–0.321	High-grade red brass; general use
4B	30,000	12,000	15–27	—	50–60	0.311–0.314	Free-machining brass alloy; fittings
5A	29,000	13,000	18–30	7.7–14.3	50–60	0.311–0.318	Low-pressure valves and fittings
5B	30,000	12,000	20–35	10.0–14	50–60	0.309–0.314	Plumbing fixtures; general hardware
6A	35,000	12,000	25–40	11.0–14	40–55	0.305–0.309	Fittings and ornamental use
6B	30,000	11,000	20–35	12.0–14	40–60	0.303–0.307	Furniture and ship trim; valves
6C	40,000	14,000	15–25	13.0–15	50–75	0.300–0.306	Spring bushing alloy; hardware; fittings
7A	60,000	25,000	15–30	12.0–14	80–95	0.289–0.303	Free-machining mang. bronze; valve stems
8A	70,000	28,000	20–35	13.0–15	90–120	0.289–0.307	Structural machine parts
8C	110,000	65,000	12–18	15.0–16.5	170–225	0.278–0.289	Heavy-duty, high-strength alloy; gears
9A	70,000	25,000	22–38	16.0–18	90–125	0.264–0.271	Corrosion-resistant applications
9B	70,000	30,000	20–35	14.0–16	100–140	0.264–0.276	Valve seats; subject to heat-treatment
9C	75,000	30,000	12–20	16.0–20	150–185*	0.271	Gears, valve seats, bushings, pump parts
10A	30,000	15,000	10–25	—	50–60	0.318–0.322	Ornamental castings, valves, fittings
10B	35,000	17,000	15–30	—	65–80	0.318–0.322	Pipe fittings, valves
11A	40,000	17,000	15–25	—	76–120	0.318–0.322	Marine castings; furniture trim
11B	50,000	26,000	15–25	—	120–150	0.318–0.322	Ornaments, valve seats, hardware

*3000-kilogram Load.

MACHINERY'S Data Sheet No. 626, January, 1949

Compiled by the
Non-Ferrous Ingot Metal Institute

BROACHES
AND BROACHING FIXTURES
Exclusively!

for
EVERY MAKE and MODEL BROACHING MACHINE . .
for
EVERY APPLICATION

Detroit Broach Company manufactures broaches and broach tooling exclusively . . . for every type machine.

Through this specialization, the application and tooling of all types of broaching machines has become a thoroughly familiar procedure. This wide experience is used to aid you in the most efficient application of broaching machines for your jobs. Then, combined with the finest manufacturing facilities, this experience is applied to design and build broach tooling that will produce the most from every production-hour.

Have Detroit Broach consult with you on your broaching applications. We will gladly give you actual cost and production data for each job.

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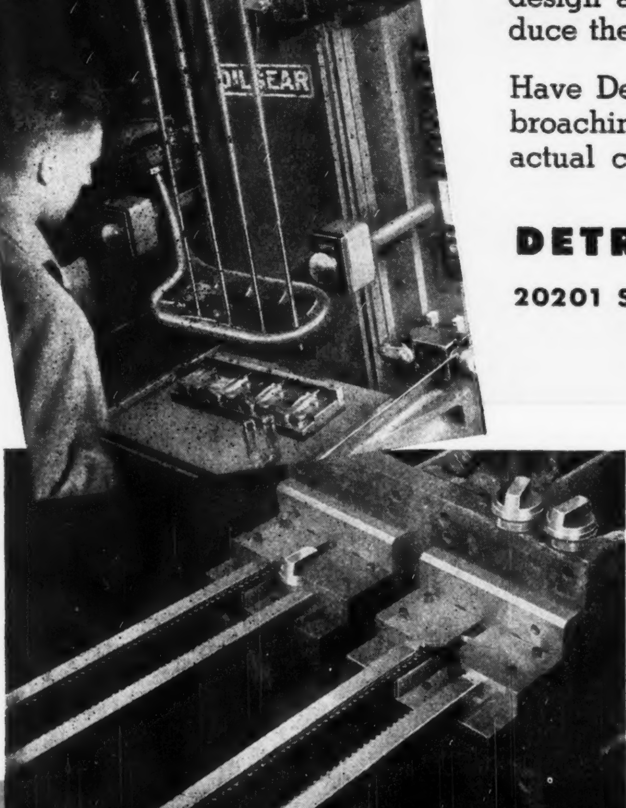

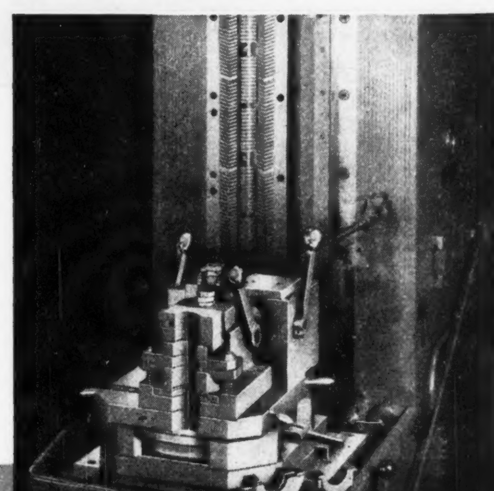

Springfield, Mass., as well as of the Morse Twist Drill & Machine Co., New Bedford, Mass. Mr. Baush has been connected with the Van Norman Co. for twenty-five years, and has handled the export business for the last seventeen years.

W. W. KUYPER has been appointed division engineer of the Turbine, Generator, and Gear Engineering Divisions of the General Electric River Works, Lynn, Mass., succeeding K. M. HOLT, who is retiring after more than forty years of service with the company. E. N. TWOGOOD, division engineer of the Gear Engineering Division, is also retiring and will be succeeded by L. J. COLLINS. Another appointment announced is that of J. J. ZRODOWSKI as designing engineer of the Gear Engineering Division.

FRANK O. LINCOLN has been elected chairman of the board of the Hy-Pro Tool Co., (subsidiary of the Continental Screw Co.) New Bedford, Mass., manufacturer of high-speed steel commercial and precision-ground taps.

NEW DEPARTURE DIVISION, GENERAL MOTORS CORPORATION, Bristol, Conn., announces the following changes in its sales department: RALPH O. WIRTEMBURG has been transferred from the position of eastern regional sales manager to take charge of special assignments originating from the general sales manager's office; JAMES P. GILLILAN, manager of the New York zone office, succeeds Mr. Wirtemburg as eastern regional manager; and CLIFTON S. FLEET will fill the vacancy created by Mr. Gillilan's transfer.

TORRINGTON CO., Torrington, Conn., announces the appointment of the following distributors for the company's line of anti-friction bearings: BEARING ENGINEERING & SALES CO., Salt Lake City, Utah; COLORADO BEARING CO., Denver, Colo.; and BEARING SERVICE CO., Waterloo, Iowa.

MARTIN C. BUTTERS, consulting engineer, formerly connected with E. I. duPont de Nemours & Co., has joined the staff of the O. K. Tool Co., Inc., Shelton, Conn., manufacturer of inserted-blade milling cutters and single-point metal cutting tools.

PENN RIVET & MACHINE CO., Milford, Conn., announces that it has changed its name to the MILFORD RIVET & MACHINE CO., PENN DIVISION.

BUTTERFIELD DIVISION, UNION TWIST DRILL CO., Derby Line, Vt., manufacturer of taps, dies, reamers, etc., announces the appointment of two new distributors: the GARRETT SUPPLY CO., 3844 S. Santa Fe Ave., Los Angeles 11, Calif., and the ARROW MACHINE TOOL CO., 251 Richmond St., Providence, R. I.

New Jersey

CLEVELAND AUTOMATIC MACHINE CO., Cincinnati 12, Ohio, manufacturer of single-spindle automatics and high-pressure hydraulic die-casting machines, announces the removal of its New York district office to 1060 Broad St., Industrial Bldg., Newark 2, N. J. R. T. CARROLL will continue in charge.

J. K. SMIT & SONS, INC., have just completed a new plant at Murray Hill, N. J., which will substantially increase the facilities of the company for producing diamond tools and wheel-dressers. It is expected that the business will be completely transferred to the new location by February 15. All communications should be addressed to 157 Chambers St., New York 7, N. Y., until further notice.

HYDRAULIC EQUIPMENT CO., manufacturer of industrial hydraulic control equipment, announces the establishment of a sales office in the Industrial Office Bldg., 1060 Broad St., Newark 2, N. J. The new office will be under the supervision of RICHARD ANDREWS, eastern sales engineer.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., announces that the manufacturing and distributing activities of its subsidiary, the RANSOME MACHINERY CO., Dunellen, N. J., are now being conducted by the parent corporation.

ADAMAS CARBIDE CORPORATION has moved from Long Island City, N. Y., to 1000 S. 4th St., Harrison, N. J., which affords quarters four times larger than the previous location.

ANTHONY ROMANO RELIABLE SCREW PRODUCTS CO. announces that it has moved into a new plant at 38 Hedden Place, East Orange, N. J.

New York

SELDEN T. WILLIAMS, vice-president of the Scovill Mfg. Co., Inc., Waterbury, Conn., has been appointed general manager of the A. Schrader's Son Division of the company, Brooklyn, N. Y. Mr. Williams joined A. Schrader's Son (Inc.) in 1929, and in 1944 was appointed vice-president of the Scovill Mfg. Co., Inc., in charge of manufacturing for Schrader domestic and foreign plants. W. T. HUNTER, who entered his fiftieth year of service last June continues as vice-president, and director of Scovill Mfg. Co., and as president of A. Schrader's Son, Inc.

RICHARD HOAGLAND has been appointed chief engineer of automatic arc-welding applications for the Acme Pattern & Machine Co., Inc., Buffalo, N. Y., builder of tools, dies, and special machinery. Mr. Hoagland has been associated with the Westinghouse Electric Corporation for the last seven years, where he was metallurgist of the Canton Naval Ordnance Plant and, more recently, equipment engineer in the arc-welding department at the Buffalo Motor Division.

Richard Hoagland, Chief Engineer of Automatic Arc-Welding Applications for the Acme Pattern & Machine Co.

FRANK L. OLDROYD has been made sales manager of the Industrial Division of Oakite Products, Inc., 22 Thames St., New York 6, N. Y. He has been associated with the organi-

Frank L. Oldroyd, Newly Appointed Sales Manager of Oakite Products Industrial Division

zation for more than fifteen years, over eleven of which he has served as field service territorial representative in various sections of the country. Prior to his present appointment, he was special field sales manager.

James W. Dice, formerly with the Westinghouse Electric Corporation and more recently assistant sales manager of Sperry Products, announces the formation of a new sales and development organization to be known as J. W. Dice & Co., with headquarters at 191 River Road, Grand View-on-Hudson, N. Y. The new company is specializing in the marketing of industrial and laboratory non-destructive test instruments employing magnetic, electronic, ultrasonic, and radiation principles.

M. L. Douglas and Foster E. Fike have recently been elected to the board of directors of the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. Mr. Douglas is manager of the company's Coraopolis, Pa., plant, and Mr. Fike, manager of the Rock Falls, Ill., plant. L. R. McWeeney, of the Port Chester plant, has been elected vice-president and assistant secretary of the company.

Howard M. Dawson has been elected president of the Jessop Steel International Corporation, Post Bldg., 75 West St., New York City. He was formerly vice-president and managing director of the corporation.

N. George Belury has been appointed president of the Engineered Castings Division of the American Brake Shoe Co., 230 Park Ave., New York 17, N. Y. He has been connected with the company since graduating from Purdue University in 1937, and has served as division vice-president, as well as in various sales capacities, including that of sales manager.

N. George Belury, President of Engineered Castings Division of American Brake Shoe Co.

Cornelius Van Deusen has been appointed assistant sales manager of the V & O Press Co., Hudson, N. Y. Mr. Van Deusen has been connected with the company for fourteen years. During the last two years he has been located in Chicago as a sales and service engineer covering the central west territories. He will make his headquarters at the Hudson plant.

Harrison J. Groo, formerly connected with the George B. May Co., Manning, Maxwell & Moore, Inc., and Baldwin-McLean, Inc., has joined the Cosa Corporation, New York 17, N. Y. as sales engineer covering the Metropolitan New York territory. Robert H. Bennet has been appointed district sales manager of the corporation in the New England territory.

John A. Proven has been appointed general sales manager of the Porter-Cable Machine Co., Syracuse, N. Y., manufacturer of portable electric tools, floor-sanding machines, and abrasive belt grinders. He previously held the position of vice-president and sales manager of the Sterling Tool Products Co., Chicago, Ill.

Henry C. Young announces that the partnership of D. J. Young and Henry C. Young, conducted under the name of D. J. Young Tool & Machine Works, has been dissolved and that he is continuing to do business under the name of H. C. Young Tool & Machine Co. at 1007 Spring St., Syracuse, N. Y.

Orest A. Meykar has opened an office as a professional engineer at 2817 Astoria Blvd., Long Island City 2, N. Y., specializing in mechanical engineering and production mechanization problems.

Jonathan D. Freeze has been appointed district sales manager for the New York territory of the Jessop Steel Co., Washington, Pa. His offices are at 30 Church St., New York City.

Lionel Tinfow has been added to the sales engineering staff of the New York branch office of the Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa.

Charles D. Eichorn has been appointed sales representative of the New York branch of Berger Mfg. Division, Republic Steel Corporation. He became associated with the locker sales department in 1947.

E. V. Crane, Newly Appointed Chief Engineer of Hydraulic Press Mfg. Co.

Ohio

E. V. Crane has been appointed chief engineer of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Mr. Crane was associated for twenty-four years with the E. W. Bliss Co. in various research and engineering capacities, resigning in 1945 to join the consulting and research organization of Sam Tour & Co., Inc., as vice-president in charge of the mechanical engineering department.

William J. Hall has been appointed production manager of the Ivanhoe Division of the Reliance Electric & Engineering Co., Cleveland, Ohio, manufacturer of electric motors. Mr. Hall joined the company in 1935 as

William J. Hall, Production Manager of the Ivanhoe Division of Reliance Electric & Engineering Co.

(Left) Frank W. Eichman, Newly Appointed Sales Manager of Philadelphia Plant of Joseph T. Ryerson & Son, Inc. (Right) C. H. Hallett, New Manager of Sales at the Los Angeles Plant

a dispatcher in the production department, and has been night superintendent of the Ivanhoe Division for the last two years.

Lincoln Electric Co., Cleveland, Ohio, announces the following changes in its district managers: C. W. Lytton has been made district manager for the Buffalo, N. Y., area, with office at 1700 Niagara St. He was previously district manager at Franklin, Pa. C. M. Richardson has been appointed district manager for the northwestern Pennsylvania district of the company, with office at 741 Liberty St., Franklin, Pa. He has been district manager for the last six years at the Toledo, Ohio, office. Ray Zeh succeeds Mr. Richardson as district manager of the Toledo office. Mr. Zeh was previously connected with the Milwaukee, Wis., office.

Henry T. Schlachter has been appointed representative in southern Ohio and northern Kentucky for the Detroit Broach Co., Detroit, Mich. Mr. Schlachter's office is at 426 Transportation Bldg., Cincinnati 2, Ohio. He was formerly mid-western field manager of the Cimcool Division of the Cincinnati Milling Machine Co.

C. Allen Fulmer Co., Cincinnati 2, Ohio, manufacturer of hydraulic honing machines, has been made distributor throughout the United States of the Alexander Ball line of British-built honing tools.

B. A. Woina, formerly chief engineer of the Mullins Mfg. Co., Salem, Ohio, has been made a director of the Sheet Metal Products Development and Production Engineering Division of Designers for Industry, Inc., Cleveland 13, Ohio.

Pennsylvania and Maryland

Frank W. Eichman has been appointed sales manager of the Philadelphia plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. Eichman's entire business career has been spent with the Ryerson organization. He started at the New York plant of the company in 1922. Prior to his present appointment, he was sales representative at Philadelphia. C. H. Hallett has been appointed manager of sales at the Los Angeles, Calif., plant of the company. He has been associated with the Ryerson organization since 1941.

James W. Fatkin has been made manager of manufacturing for the Aviation Gas Turbine Division of the Westinghouse Electric Corporation, Pittsburgh, Pa., replacing Samuel S. Stine, who recently was named plant manager of the corporation's new Kansas City works. Other appointments announced recently include Peter A. Roos as superintendent of blade and diaphragm manufacturing at Philadelphia, the post previously held by Mr. Fatkin, and Dewey H. Martz as superintendent of assembly and test for the division at its Philadelphia plant.

Charles Lukens Huston on December 15 began his seventy-fourth year of continuous service with the Lukens Steel Co., Coatesville, Pa.—a unique record in the annals of American industry. Mr. Huston, the grandson of Dr. Charles and Rebecca Lukens, for whom the company is named, is now in his ninety-third year. He started with the concern on December 15, 1875 as a clerk and bookkeeper. Today, as first vice-president, he is still active, walking to his office daily from his nearby home.

H. E. Balsiger has been appointed director of engineering for the Landis Tool Co., Waynesboro, Pa., manufacturer of precision cylindrical grinding machines. Mr. Balsiger joined the company in 1925. R. E. Price, formerly assistant chief engineer, succeeds Mr. Balsiger as chief engineer, and W. E. Happel becomes assistant chief engineer.

Nelson C. Walker was recently appointed assistant district manager of the Berwick, Pa., plant of the American Car and Foundry Co. Mr. Walker has had a wide experience in industrial engineering and management. Prior to his present appointment, he was president of the United Tank Corporation.

Howard E. Hornickel has been appointed assistant superintendent of the Donora, Pa., Zinc Works of the American Steel & Wire Co., Cleveland, Ohio, a subsidiary of the United States Steel Corporation.

McMillan Robinson has been appointed sales manager for the Metal Products Division of Koppers Co., Inc., Baltimore, Md. This division was formed last August to combine the company's manufacturing activities in the Baltimore area. Mr. Robinson was formerly vice-president and sales manager of the Ocean City Mfg. Co. of Philadelphia.

Wisconsin

J. H. Park has been appointed sales manager of Electro Machines, Inc., Cedarburg, Wis., manufacturer of the

J. H. Park, Recently Appointed Sales Manager of Electro Machines, Inc.

GISHOLT TURRET LATHES

INSTANT SPEED CHANGES at the *FLIP* of a *FINGER!*

No manual gear shifting. Just touch this knob for quick high-low or low-high spindle speed shifts. A great timesaver — *Boosts Production!*

Speed changes (6-1 ratio) are made by hydraulically operated clutches. This standard feature on all Gisholt Turret Lathes is a big advantage in drilling-tapping, boring-reaming, and turning-threading operations.

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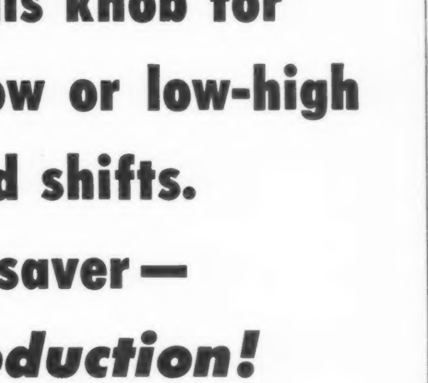
THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Doerr line of electric motors. Mr. Park was formerly associated with the Westinghouse Electric Corporation. He has been with Electro Machines, Inc., in a sales capacity since January 1, 1948.

F. C. Berliner has joined Maysteel Products, Inc., Mayville, Wis., manufacturers and designers of metal specialties, in the capacity of sales manager.

* * *

Long Conveyor Belt Utilizes Cotton and Nylon Fibers for Strength

A new rubber and fabric heavy-duty conveyor belt, more than a mile in length and capable of carrying 300 tons of coal per hour, was designed and produced at the Passaic, N. J., plant of the United States Rubber Co. Put into operation at the Storrs Colliery near Scranton, Pa., it will mean a substantial boost in production of anthracite coal for two principal reasons. It reopens rich veins of hard coal that have not been mined since 1931, and it simplifies and speeds up production of coal from veins now being mined, replacing the costly system of hauling by mine car and truck.

The new belt is said to be 250 to 400 per cent stronger than other belts of rubber and fabric construction. It is made of a special belting fabric known as Ustex Nylon, which combines high-strength cotton and nylon fibers. It is 36 inches wide, and is powered by a 400-H.P. drive.

The belt hauls coal continuously to the surface from a point 2640 feet under ground, and it serves mining operations which extend for more than a mile in all directions from its underground terminal. Coal is put on the moving belt at two central loading points fed by a system of chain conveyors and mine cars. It is brought to the surface at an incline of 15 degrees, and then transferred to a 1300-foot conveyor belt operating above ground.

* * *

British to Buy Machine Tools for Automobile Plants

A considerable number of machine tools, as well as other capital equipment, will be purchased in this country for the British automotive industry in an effort to further modernize its plants, according to Sir William Rootes, chairman of the Rootes Group, British motor car producers, who recently arrived in the United States. On Sir William's previous visit, more than $1,500,000 worth of machine tools were purchased by his firm.

Coming Events

January 10-14 — Annual meeting and Engineering Display of the Society of Automotive Engineers at the Book-Cadillac Hotel in Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

January 10-14—Materials Handling Exposition at Convention Hall, Philadelphia, Pa. Sponsored jointly by the Management and Materials-Handling Divisions of the American Society of Mechanical Engineers and the Material Handling Institute. Further information can be obtained from Clapp & Poliak, Inc., 350 Fifth Ave., New York 1, N. Y.

February 28 — March 4 — Spring meeting of the American Society for Testing Materials at the Hotel Edgewater Beach, Chicago, Ill. For further information, address the Society at 1916 Race St., Philadelphia, Pa.

March 3-5—Fifth annual conference of the American Society of Training Directors at the Hotel Carter, Cleveland, Ohio. Chairman of the Publicity Committee, L. W. Morgan, Care of the Yoder Co., 5500 Walworth, Cleveland, Ohio.

March 8-10—Passenger Car, Body, and Production Meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

March 10-12—Seventeenth annual meeting of the American Society of Tool Engineers at the Hotel William Penn in Pittsburgh, Pa. Executive secretary, Harry E. Conrad, 1666 Penobscott Bldg., Detroit 26, Mich.

March 28-30—Transportation Meeting of the Society of Automotive Engineers at the Statler Hotel in Cleveland, Ohio. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

April 8-22 — German Industrial Exhibit to be held at the Museum of Science and Industry, 30 Rockefeller Plaza, New York City. Exhibit sponsored and arranged by the Joint Export and Import Agency in Frankfort, Germany.

April 11-13—Aeronautic and Air Transport Meeting of the Society of Automotive Engineers at the Hotel New Yorker in New York City. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

April 11-16—Sixth Western Metal Congress and Exposition at the Shrine Auditorium, Los Angeles, Calif. For further information, address National Secretary of American Society for Metals, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

April 25-28 — Fourth Southern Machinery and Metals Exposition in the Atlanta Municipal Auditorium, Atlanta, Ga. Michael F. Wiedl, managing director, 267 E. Paces Ferry Road, N.E. Atlanta, Ga.

May 10-13 — Eighteenth annual National Packaging Exposition in the Public Auditorium, Atlantic City, N. J. Sponsored by the American Management Association, 330 W. 42nd St., New York 18, N. Y.

June 27-30 — Thirty-Sixth Annual Convention of the American Electroplaters Society in Milwaukee, Wis., with headquarters at the Schroeder Hotel. For further information, address the Society at 473 York Road, Jenkintown, Pa.

June 27-July 1—Annual meeting of the American Society for Testing Materials at the Hotel Chalfonte-Haddon Hall, Atlantic City, N. J. Headquarters of the Society, 1916 Race St., Philadelphia 3, Pa.

* * *

Examinations for Apprenticeship Representatives

The United States Department of Labor Bureau of Apprenticeship, Washington, D. C., announces examinations for apprenticeship representative or officer and apprenticeship standards examiner. The salaries for these positions range from $3727 to $7432 a year. Complete details, including qualifications and experience required, can be obtained from the United States Civil Service Commission, Washington 25, D. C., or from any first or second class post office, or regional headquarters of the Civil Service Commission. Applications must be received by the United States Civil Service Commission in Washington not later than January 18.

* * *

Automobile Production in 1948 Almost Equalled Record

Automotive plants in the United States in 1948 failed by only about 76,000 vehicles (less than four days' output) to beat the all-time production mark established in 1929. They were unable to produce to full capacity because of inadequate steel supplies. It has been estimated that the amount of steel available to the automotive industry during 1949 will be about 10 per cent greater than last year.

How many of these toolmaking aids can you use?

Here's valuable information to bring you up-to-date on modern toolroom practices...tips on increasing die life, procedures for precision hole location, applying toolroom methods to production work, and many others.

Much of this authoritative technical data was originally published in leading trade journals in the metal working field. Now all are available in reprint form from Moore. Just use the coupon and circle the numbers of the literature you want. It's free.

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2 **Model No. 1 Moore Jig Borer Catalog.**

3 **Model No. 2 Moore Jig Borer Catalog.**

4 **Correcting Hole Location Within .0001"**—With Moore Jig Grinders.

5 **Grinding Lead Screws Accurate to .0002" in 16"**—How lead screws for Moore Jig Borers and Jig Grinders are produced to such precise dimensions.

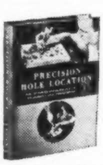
6 **Small Hole Grinding with Diamond-Charged Mandrels**—How it's done and the advantages over other methods.

7 **Jig Grinders Tackle Production Problems**—Case history of a tough grinding assignment.

8 **Combination Grinding Wheel Dresser**—Roll-Crushing and diamond-dressing of surface grinder wheels in one machine.

9 **Diamond or Crush-Dressed Wheels for Contour Grinding**—Applications and advantages of each method.

10 **Die Flipper "Mechanizes" Die Assembly and Try-Out Operations**—How one diemaker, alone, can assemble or take apart large dies, test alignment, drill punches in place, tap for screw holes, and perform all necessary try-out operations.



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Here's your best source book on modern toolmaking practices—over 400 illustrations, 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes, 448 pages of text in all. Over 5000 copies sold to date.

"Precision Hole Location" is available at a special price of $3.00 in U.S.A.; $3.50 outside U.S.A. Include your check or money order with the coupon below and a copy can be sent in the same mail with your free technical articles.

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New Books and Publications

PRECISION MEASUREMENT. By Jack Johnson. 181 pages, 6 by 9 inches. Published by the Pitman Publishing Corporation, 2 W. 45th St., New York 19, N. Y. Price, $3.

In certain types of precision inspection, some parts, such as those of irregular shape, cannot be measured directly by the use of tools, but require mathematical calculations for checking. The average tool inspector does not usually have the background for this type of applied mathematics. The purpose of this book is to describe methods used in checking work of this type and to provide the necessary formulas. The problems presented in the text have been drawn directly from the shop, and the accompanying solutions are carried through step by step, using a large number of set-up drawings to make the solution clear. They cover the checking of tapers, dovetail angles, relief on dies, the two- and three-wire method of checking threads, measuring radii, locating holes for index-plates, and many other jobs. The formulas given are selected as representative of many problems encountered by an inspector.

MECHANICS OF MACHINERY. By C. W. Ham and E. J. Crane. 538 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $5.

The third edition of this text-book on mechanics of machinery includes important new subjects and incorporates changes and improvements that bring the material up to date. Among the principal additions are chapters dealing with vibrations and critical speeds in shafts, and the gyroscope. New material is included in the chapters on cams and gears, flywheels and governors, and on balancing, with particular reference to airplane engines. The selection of drafting-room problems has been made with a view to illustrating practical application of the fundamental theory. The general arrangement of this book is the same as in previous editions, the material being divided into two main sections—Part I, dealing with the subject of mechanism, and Part II, with kinematics and dynamics of machinery.

JET-PROPULSION DESIGN. By C. A. Norman and R. H. Zimmerman. 286 pages, 6 by 9 inches. Published by Harper & Brothers, 49 E. 33rd St., New York 16, N. Y. Price, $5.

The universal interest and intensive experimentation today in rockets, jet-propulsion apparatus, and gas turbines make this book of outstanding importance. The material presented is elementary and practical. It deals with both the performance and design of details of jet-propulsion apparatus and of gas turbines applicable in stationary, aircraft, marine, and locomotive plants. Being written for the beginner in the field, the book avoids complex theories that do not contribute to fundamental understanding and intelligent use in design. Many typical design problems are included.

A.S.M.E. MECHANICAL CATALOG AND DIRECTORY (1949). 738 pages, 8½ by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

This condensed collective mechanical catalogue covers the products of 4600 manufacturers and contains 48,500 listings. As in previous editions, the catalogue material is arranged alphabetically, according to the manufacturer's names. Eleven main industrial groups are included. In addition to the catalogue material, there is a directory section, of 300 pages, which lists the products covered in the catalogue material under 6500 classifications, together with the names and addresses of the manufacturers. A third section of the book contains an alphabetical list of trade names supplied by the firms listed.

TURNING AND BORING PRACTICE. By Fred H. Colvin and Frank A. Stanley. 531 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $4.75.

This is the third edition of a book designed to provide a guide to those interested in the operation of turning and boring machines. It presents the essential principles and major problems involved in the different operations; describes the most important types of machines and methods of operating them; and gives data on speeds and feeds, new cutting alloys and materials, use of coolants, etc. The sections to which data has been added include those on mandrel and taper work in lathes; precision boring; boring-bars for special work; and carbide tools.

A.S.T.M. STANDARDS ON COPPER AND COPPER ALLOYS. 516 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price (paper-bound), $4.35; (cloth-bound), $5.

A total of 106 standard specifications, test methods, definitions of terms, etc., covering copper and copper-base alloy products, developed by the American Society for Testing Materials, are presented in this volume. The specifications cover cast and wrought alloys, copper wire and cable, electrodes and non-ferrous metals used in copper alloys.

SURVEY OF AUTOMATIC ARC AND GAS WELDING PROCESSES AS USED IN THE AUTOMOTIVE INDUSTRY. 17 pages, 6 by 9 inches. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, 30 cents.

* * *

New Book on Foremanship Training

A book designed to be used in the continuous training of supervisors, junior executives, and key men in manufacturing companies has been announced by the National Metal Trades Association, 122 S. Michigan Ave., Chicago, Ill. This book consists of fifty-two conference units, of four pages each, which have previously been published individually and are now brought together and bound in a ring-binder, together with a complete index. Each of the units covers a subject of prime importance in factory management.

This new work, entitled "Foremanship—A Practical Guide," is intended to be used in connection with a series of conference meetings for the supervisory personnel of a factory or a group of closely related factories. To aid plants in carrying out their supervisory training programs, the Association has also published a companion volume called "Conference Leaders Manual," which is intended to describe applications of the principles discussed in the Guide. These publications are being made available to management generally. The price of "Foremanship—A Practical Guide" is $15, and that of the "Conference Leaders Manual" is $7.50.

* * *

The DeVilbiss Co., 300 Phillips Ave., Toledo 1, Ohio, announces several one-week courses for industrial finishers, maintained as a service to users of DeVilbiss equipment. These tuition-free courses on function, care, and operation of spray painting equipment combine class-room instruction and demonstration with actual use of the equipment. Identical courses lasting one week each, will begin on January 10, February 21, March 7, May 2, and June 20. Those who wish to enroll should communicate promptly with the company at the address given above, as the size of the class necessarily has to be limited.

Design, Construction, Operation of Metal-Working Equipment and Manufacture of Metal Products

MACHINERY

VOLUME 55 FEBRUARY, 1949 NUMBER 6

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